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AUTHOR Simms, James C., Comp.; T[illegible]ed, Stephen C., Comp.

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ABSTRACT

Intended as a teaching and learning guide for use with high school students who are interested in the occupation of mine equipment repairman, this beginning course is designed to give students the opportunity to develop the necessary skills required to perform the tasks of a mine equipment repairman; acquire the related information necessary to exercise good judgment in carrying out the construction, maintenance, servicing, and repairing operations; and develop an appreciation of good workmanship, safety, and correct work habits and attitudes. The guide is designed as a three-year curriculum involving approximately fifteen hundred hours of class and laboratory instruction. It is arranged into the following seven units, representing the major divisions of the trade: orientation, health and safety, mine interior construction, mining procedures/machinery/equipment, mine mechanical maintenance, mine hydraulic maintenace, and mine electrical maintenance. Each unit includes job sheets and skill competency sheets. The job sheets are arranged in an order that gradually exposes the skill competencies and insures the introduction of each operation or skill competency in a controlled manner. Each job sheet includes the material and equipment needed, safety precautions, competency procedures/steps, corresponding teaching/learning activities, and method of evaluation. Operation sheets supplement the job sheets and indicate to the student how to perform the many skill competency operations necessary to complete the assigned jobs. Each includes behavioral objective, competency procedures/steps, corresponding teaching/learning activites, and method of evaluation. (BM)

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TRADE AND INDUSTRIAL EDUCATION

COURSE OF STUDY

FOR

Mine Equipment Maintenance

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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COMPILED BY

James C. Simms and Stephen C. Tweed
Customer Training Center
Joy Manufacturing Company

IN COOPERATION WITH

Joy Manufacturing Company, Franklin, Penna.
and
North Fayette County Area Vocational Technical School,

AND

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Bureau of Vocational Education
Harrisburg, Pennsylvania

1976

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Vocational Program Development Division
T. Dean Witmer, Chief

Trade and Industrial Education
Robert Jacoby, Senior Program Specialist

Pennsylvania Department of Education
Box 911
Harrisburg, PA 17126

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PREFACE

In recent years, we have planned and constructed the finest of vocational education facilities and have placed fine equipment in these facilities. Equal attention must be directed to provide the teacher with the basic tools for instruction to assist in providing quality instruction.

This basic course of study is intended to be used as a teaching and learning guide. The information provides the essentials of the occupation, insuring that the students who successfully complete the course will have sufficient competencies for initial employment and ample orientation for growth and advancement. The teacher who uses this course may find it necessary to modify and supplement the material to meet the needs of specific students and the local industrial community.

This material has been prepared by Mr. James C. Simms and Mr. Stephen C. Tweed, Customer Training Center, Mining Machinery Division, Joy Manufacturing Company under the general direction of William Barry, Director of Vocational Education, North Fayette County Area Vocational Technical School and the Trade and Industrial Education staff of the Bureau of Vocational Education of the Department of Education.

Robert Jacoby
Senior Program Specialist
Trade and Industrial Education
Bureau of Vocational Education
1976

INTRODUCTION

This course is intended for secondary school students who are interested in securing employment as mine equipment repairmen. It is designed as a beginning course in mine equipment repair, and would usually be offered to tenth grade students.

The course is designed to give the students an opportunity to:

1. Develop the necessary skills required to perform the tasks of a mine equipment repairman.
2. Acquire the related information necessary to exercise good judgment in carrying out the construction, maintenance, servicing and repairing operations required of a mine equipment repairman.
3. Develop an appreciation of good workmanship, safety, and correct work habits and attitudes.

This course will be conducted as a part of the vocational education program of a school district, and will be administered through the facilities of the local vocational program as a trade preparatory course.

Educational Philosophy of the School System

The primary function of the educational program in any community is the development of the individual citizen, youth or adult, in all his capacities, so that he will be a good mamber of the community and of the larger democracy of which he is a part.

Basic Philosophy of Vocational Ecucation

Vocational education, as an integral part of the total education program of the community, makes a contribution toward the development of good citizens - - including their health, social, civic, cultural and economic interests. Its chief purpose is to prepare individuals for gainful employment through the development of skills, knowledges, understandings, attitudes, work habits, appreciations, leadership qualities and citizenship qualities.

Basic Philosophy of Vocational Industrial Education

Vocational industrial education is a phase of vocational education that provides instruction and experience for the purpose of fitting persons for gainful employment in trade, technical and industrial pursuits. The major objectives of this program are as follows:

1. To provide instruction of a preparatory type in the development of basic manipulative skills, safety judgment, technical knowledge, and related technical information for the purpose of fitting persons for gainful employment.
2. To provide instruction for an extension type for the further development of performance skills, technical knowledge, related technical information, safety and job judgment for persons already employed.

Instruction in vocational industrial education is provided for four general groups:

1. Journeymen and other industrial workers who need extension instruction in industrial subjects.
2. Apprentices and other learners who need instruction in trade, technical and industrial subjects.
3. Out-of-school youth who need training and experiences, coordinated by public school authorities, to fit them for gainful employment.
4. In-shcool youth who have selected an occupation and who need training for entrance into a trade, technical or industrial pursuit.

This course for the training of mine equipment repairmen falls under the fourth category.

GENERAL COURSE OBJECTIVES

	Objectives		Suggested Activities to Achieve Objectives
1.	To develop specific skill competencies and related information associated with mine maintenance.	1.	Series of individual and group practice jobs.
		2.	Use of job sheets, operation sheets, information sheets for individual students.
		3.	Field trips to various mine sites.
2.	To develop the ability to work co-operatively with other students.	1.	Program class and group projects.
		2.	Encourage students to assist each other.
		3.	Assign advanced students to assist students needing help.
3.	To develop good habits of work.	1.	Provide specific standards for each job.
		2.	Maintain a clean, well-organized shop area and classroom.
		3.	Discuss with students the impottance of good work habits and their relationship to efficiency.
4.	To perform work in a safe and orderly manner.	1.	Demonstrate correct safety practices.
		2.	Provide safety equipment for all hazardous work activity.
		3.	Stress safety in information/lecture lessons.
		4.	Correct safety practices to be used as a student evaluation criteria.
		5.	Display safety posters.
5.	To develop an understanding of labor and management.	1.	Become familiar with trade journals and magazines.
		2.	Arrange for presentation by union and management representatives.
		3.	Arrange field trips.
		4.	Discuss labor/management problems
6.	To stimulate the development of leadership.	1.	Provide opportunity for students to plan their assigned work tasks and write their own job sheets.
		2.	Provide a method for work appraisal by students.
		3.	Assign project leaders.
7.	To become aware of job opportunities in the industry.	1.	Solicit job information literature from various industry employers.
		2.	Conduct field trips and employer presentations.
		3.	Utilize school guidance services and cooperative coordinators.

PLAN OF INSTRUCTIONAL PRACTICE

The effectiveness of instruction depends on the careful organization and control of the routine details concerning the management of the pupil, equipment, teaching methods and the physical laboratory arrangement. The teacher must determine the best management practices and formulate a very definite statement of the basic standards to be followed in teaching the course to bring about the attainment of the learning goals.

Length of Course

The course of study is designed as a three-year curriculum involving approximately 1500 hours of class and laboratory instruction, primarily for beginning students who are interested in securing employment in the occupation. Where job entry is the goal, the entire course of study would be appropriate. In adults programs, it may be found that a single thrust is the student's goal, therefore, the course content may be restricted to a single major division.

Use of This Course of Study

The material has been arranged in major divisions of the trade. In most cases, the material contained in the first division must be learned before progressing to the next division. The nature of some trade areas permit entry into random divisions after the introductory basic material is covered. Some divisions of the occupation can be taught separately.

The content of this course material consists of job sheets (yellow) and skill competency sheets (green). The skill competency (SC) sheets are simply written and highly illustrated. These sheets outline the manipulative handling of tools and materials that make up the doing part of the occupation. The sequence of the skill competency sheets (SC) is based on the organization of the job sheets. Notice that job number one incorporates the basic skill competencies and job number two includes additional skill competencies. This cumulative reuse of the skill competencies continues throughout the entire job sheet collection. After a number of jobs have insured that the student has been sufficiently exposed to a skill competency, no further reference to that skill competency is made.

The job sheets are arranged in an order that gradually exposes the skill competencies. The purpose of the job sheet is to insure the introduction of each operation or skill competency in a controlled manner. Look at this group of jobs as a framework that can be added to, by you, to meet local needs. You may decide to design new or different jobs that will be inserted between or replace any of the suggested jobs. In time you will be able to custom design a course of study for your own needs. There will be little or no need to vary the skill competency sheets.

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HOW TO READ AN AC WIRING DIAGRAM, Joy Manufacturing Co.

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MODERN MINING METHODS, Joy Manufacturing Co., 1972.

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COURSE OUTLINE

Instructional Title: **Mine Equipment Maintenance** **Code: 17.2391**

OCCUPATIONAL DESCRIPTION

Performs mechanical maintenance on equipment used in mining. Repairs, adjusts, and maintains mining machinery such as continuous miners, shuttle cars, air compressors, and haulage equipment. Welds, straightens and refits parts such a body framework.

Tests, adjusts and repairs hydraulic systems following blueprints and schematic drawings. Connects hydraulic units and systems to test panels and attaches supplementary equipment such as hoses, valves, gates, vibration equipment, and mechanical, electrical or electronic controls devices at designated locations. Records test results, evaluates test date to determine causes of malfunctioning of hydraulic units and makes adjustments and repairs. May install hydraulic systems and also test after installation.

Repairs, maintains and installs electric motors, switchboards, control panels, fans, and starting devices for mining equipment working from blueprints. Tests installation of equipment by using electrical test devices. Examines bearings, shafts and other parts for wear or defects, and make installations, when necessary. Lubricate gears and other moving parts using oil can, grease gun, and paddle.

Must know when to make tests for the various gases; where the tests should be taken; how to obtain accurate identification of gases; what to do when dangerous gases are detected; and the proper maintenance of these test devices.

Persons will perform all work according to the safety standards set by the mine and have a knowledge of first aid practices.

MAJOR DIVISIONS OF THE OCCUPATION

I. Orientation
II. Health & Safety
III. Mine Interior Construction
IV. Mining procedures, machinery and equipment
V. Mine Mechanical Maintenance
VI. Mine Hydraulic Maintenance
VII. Mine Electrical Maintenance

Teaching Methods

The following procedures are offered as the most productive in achieving the desired results in this course.

1. Demonstrations - Operations and Procedures will be demonstrated while the students observe. The purpose is to show how things are done correctly and safely.
2. Class Discussion - A method of teaching in which the students and the teacher take part, directed and controlled by the teacher to a predetermined objective. Technical and related information common to a class or group of students will be presented in this manner. Evaluation of the material presented in this manner should be done by objective testing.
3. Laboratory Talks - Short, informal talks by the instructor during laboratory activities to convey information pertinent to the acticity in progress. Not scheduled and not timed, this activity should occur at any appropriate time and for periods of varying duration.
4. Observation and Input - This teacher activity should take place at all times when students are performing psychomotor skills, The purpose is to reinforce a previously given demonstration, class discussion, or laboratory talk, or to update the students' skills by further demonstration and/or further disclosures of technical and related information.

Vehicles of Instruction

The application phase of this course will consist of work assignments kept as close to industrial conditions as a shop situation permits. Job, operation and information sheets will be provided, so that students of different levels of skill and ability can understand them. The students will be encouraged to progress as rapidly as possible, and achieve the standard set for the course. Special attention will be given to the unique student, offering special assistance so that slow as well as fast students may progress at their own rate of speed.

Teaching Aids

Some of the teaching aids recommended for this course include: films, slide-tape programs, overhead transparencies, video tapes/cassettes, hands-on training panels, related worksheets, industrial samples, speakers (professional/tradesmen), chalkboards, etc. A complete list of texts and references is given in the bibliography.

Items for Development by Local Teacher

The following items are peculiar to the local school situation and need to be developed by each local instructor.

- Standards for attainment required of students
- Pupil work evaluation and grading
- Shop controls and regulations
- Pupil personnel organizations
- Method of tool control
- Records and forms

SKILL COMPETENCY DEVELOPMENT JOBS

These are suggested typical jobs to provide experiences to assist the student to learn the skill competencies of the occupation. These are job titles only – the numbers preceding each title correspond with the identifying numbers found on the JOB SHEETS which follow:

UNIT I. ORIENTATION

UNIT II. HEALTH & SAFETY

A. Ventilation
J-2A-1 Develop Ventilation Plan for Seven Entry Section
J-2A-2 Layout Ventilation in MOdel Mine
J-2A-3 Measure Air Flow Across Coal Face
B. Mine Gases
J-2B-1 Identify Posionous Gases
J-2B-2 Identify Explosive Gases
C. Fires & Explosions
J-2C-1 Locate Fire Protection Equipment
J-2C-2 Show Method of Rescue
D. First Aid
J-2D-1 Treat Victim of Electrical Shock
J-2D-2 Treat Compound Fracture
J-2D-3 Treat Severe Lacerations
J-2D-4 Treat Head and Neck Injury
E. Instruments
J-2E-1 Maintain Flame Safety Lamp
J-2E-2 Maintain Methane Detector
J-2E-3 Maintain Bulb Type Gas Detector

UNIT III. CONSTRUCTION

A. Roof Control
J-3A-1 Design A Roof Control Plan for Entries And Intersections
J-3A-2 Design a Roof Control Plan Using A Combination of Roof Bolts and Timbers to Allow Entry Widths Exceeding 20 feet
J-3A-3 Design a Roof Control Plan for Bad Roof Areas of Entires and INtersections
J-3A-4 Roof Control for Pillar Extraction
B. Ventilation Structures
J-3B-1 Construction of a Blowing System with a Line Curtain
J-3B-2 Construction of a Blowing System with Auxiliary Fans
J-3B-3 Construct a Dual Split Ventilation System Where Overcasts are Used
C. Track & Trolley Layout
J-3C-1 Design a Track and Trolley INstallation
D. Water Control
J-3D-1 Design a Water Removal Plan

UNIT IV. MINING PROCEDURES, MACHINERY & Equipment

J-4-1 Prepare Face for Blasting
J-4-2 Prepare Blasting Agents

J-4-3	Firing Blasting Agents
J-4-4	Cutting Machine Preventive Maintenance
J-4-5	Face Drill Preventive Maintenance
J-4-6	Loader Preventive Maintenance
J-4-7	Shuttle Car Preventive Maintenance
J-4-8	Roof Bolter Preventive Maintenance
J-4-9	Continuous Miner Preventive Maintenance
J-4-10	Belt Conveyor Preventive Maintenance
J-4-11	Locomotive & Trolley Preventive Maintenance
J-4-12	Dump & Scoop Preventive Maintenance

UNIT V. MINE MECHANICAL MAINTENANCE

	A. Interpreting Engineering Drawings
J-5A-1	Assemble Parts According to Drawings
J-5A-2	Disassemble Parts According to Drawings
	B. Oxyacetylene Maintenance Welding
J-5B-1	Construct a Box Without Welding
J-5B-2	Construct a Box with Welding Rod.
	C. Oxyacetylene Cutting
J-5C-1	Given a Template Cut a Piece of 1/8-inch Plate
	D. Direct Current Maintenance Welding
J-5D-1	Given a Detail Drawing, Weld the Component.
	E. Alternating Current Maintenance Welding
J-5E-1	Given a Detail Drawing, Weld the Component
	F. Machines and Mechanics
J-5F-1	Calculate the Efficiency of a Mechanical Assembly
	G. Gears
J-5G-1	Rebuild a Gathering Head Reducer
	H. Chains and Sprockets
J-5H-1	Assemble a Conveyor Chain on a Loading Machine
	I. Mine Mechanical Units
J-5G-1	Remove and Replace a Rear Conveyor on a Loading Machine

UNIT VI. HYDRAULICS

	A. Basic Principles
J-6A-1	Demonstrate Pressure in a Fluid Due to Weight
J-6A-2	Demonstrate Pressure in a Fluid in an Enclosed Cylinder
J-6A-3	Demonstrate Power Transfer by Cylinders
J-6A-4	Demonstrate Power Transfer by Motor
J-6A-5	Demonstrate Power Losses (Orifice, Friction, etc.)
	B. Basic Circuits & Components
J-6B-1	Demonstrate Pump Flow and Pressure Characteristics
J-6B-2	Demonstrate Accumulator Flow and Pressure Characteristics
J-6B-3	Setup Basic Circuit Using Pump and Cylinder
J-6B-4	Setup Basic Circuit Using Pump and Motor

J-6B-5	Setup Relief Valve in Simple Circuit
J-6B-6	Setup Simple Circuit Using a Series Type Open Center Directional Control Valve
J-6B-7	Setup Simple Circuit Using Parallel Type OPen Center Directional Control Valve
J-6B-8	Setup Simple Circuit Using Shut Off Valve
J-6B-9	Setup Simple Circuit Using Check Valve (Pilot Operated)
J-6B-10	Setup Simple Circuit Using Sequence Type Directional Control Valve
J-6B-11	Setup Simple Circuit Using Counterbalance Type Valve
J-6B-12	Setup Simple Circuit Using Pressure Reducing Valve
J-6B-13	Setup Simple Circuit Using Flow Control Valves
J-6B-14	Setup Simple Circuit Using Unloading Valve and Relief Valve
	C. Miscellaneous Hydraulics
J-6C-1	Demonstrate Filter Types
J-6C-2	Demonstrate Cooler Types
J-6C-3	Demonstrate Hydrostatic Transmission Types
J-6C-4	Setup Circuit Using Pipe Fittings
J-6C-5	Setup Circuit Using JIC Fittings
J-6C-6	Setup Circuit Using Staple Type Fittings
J-6C-7	Demonstrate Fluid Types and Their Characteristics

UNIT VII. ELECTRICITY

	A. Elements of Electricity
J-7A-1	Build A Wet Cell Battery
J-7A-2	Disassemble a Dry Cell
J-7A-3	Build An Electromagnet
J-7A-4	Demonstrate Alternating and Direct Current
J-7A-5	Calculate Resistance, Voltage, Current & Power
J-7A-6	Build Basic DC Circuit
J-7A-7	Build a DC Motor
J-7A-8	Build a DC Generator
J-7A-9	Build Series and Parallel Circuits
	B. Basic AC Circuits
J-7B-1	Design and Build a Light Circuit
J-7B-2	Design and Build a Motor Circuit
J-7B-3	Design and Build a Motor HOlding Circuit
J-7B-4	Design Holding Circuit with Control Switch
J-7B-5	Design and Build a Circuit with a Panic Switch
J-7B-6	Design and Build a Circuit with Overload Protection
J-7B-7	Troubleshoot Circuit
	C. Direct Current Mining Machinery
J-7C-1	Draw DC Wiring Diagram Symbols
J-7C-2	Locate Components on Machine
J-7C-3	Repair a DC Contactor
J-7C-4	Repair DC Motor
J-7C-5	Trace Pump Circuit on DC Loading Machine
J-7C-6	Troubleshoot Pump Circuit
J-7C-7	Trace Head and Conveyor Circuit
J-7C-8	Troubleshoot Head and Conveyor Circuit

D. AC Mining Machinery

J-7D-1 Locate Components on Machine
J-7D-2 Trace Motor Circuit
J-7D-3 Troubleshoot Motor Circuit
J-7D-4 Repair AC Motor
J-7D-5 Repair Control Panel
J-7D-6 Repair Trailing Cable

E. Permissibility

J-7E-1 Check Trailing Cable for Permissibility
J-7E-2 Check Explosion Proof Compartments
J-7E-3 Make Overall Check of Machine

F. AC/DC Mining Machines

J-7F-1 Develop Block Model of AC/DC Circuit
J-7F-2 Trace AC/DC Traction Circuit
J-7F-3 Replace Logic Box
J-7F-4 Replace Diodes

G. SCR Mining Machines

J-7G-1 Develop Block Diagram of SCR Circuit
J-7G-2 Trace SCR Traction Circuit
J-7G-3 Troubleshoot SCR Traction Circuit

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SKILL COMPETENCIES AND INFORMATION LESSONS

The lft hand column lists the tasks or operations workers perform in the occupation which form the SKILL COMPETENCIES required of the student. These competencies should be demonstrated by the teacher and practiced by the student.

The INFORMATION LESSONS outline the general technical information and knowledge needed to perform the skill competencies. These items represent the common information taught on a group instruction basis. Additional information will emerge to be taught on an individual student basis as pupils work on the skill competencies.

The numbers preceding each title correspond to the identifying numbers of the operation sheets and the information sheets. The information lessons relate to the particular major unit of instruction but do not necessarily relate to corresponding skill competency numbers.

SKILL COMPETENCIES/OPERATIONS The student will be able to:	INFORMATION LESSONS
Unit I - Orientation	Unit I - Orientation IL 1-1-1 Overview of Mining IL 1-1-2 Geology of Coal & Ores IL 1-1-3 Location of Coal in U.S. IL 1-1-4 History of Mining Methods IL 1-1-5 Modern Mining Methods IL 1-1-6 Mining an an Occupation IL 1-1-7 Organization of a Mining Company IL 1-1-8 Union Organization IL 1-1-9 State & Federal Mining Laws
Unit II - Health & Safety A. Ventilation SC 2-1-1 Identify and Demonstrate Seven Ventilation Structures SC 2-1-2 Demonstrate Use of Map Symbols SC 2-1-3 Use of Vane Anemometer SC 2-1-4 Calculate Air Flow	Unit II - Health & Safety A. Ventilation IL 2-1-1 How & Why a Mine is Ventilated IL 2-1-2 Ventilation Structures and Equipment IL 2-1-3 Mine Conditions Affecting Ventilation IL 2-1-4 Measurement & Regulation of Air Current IL 2-1-5 Ventilation Maps IL 2-1-6 Ventilation Standards of Federal Law

SKILL COMPETENCIES/OPERATIONS

B. Mine Gases
SC 2-2-1 Identify Normal Mine Atmosphere
SC 2-2-2 Demonstrate Bulb Type Gas Detectors
SC 2-2-3 Demonstrate Methane Detecting Instruments
SC 2-2-4 Use of Flame Safety Lamp
SC 2-2-5 Remove Hazardous Gases
C. Fires and Explosions
SC 2-3-1 Identify Types of Fires
SC 2-3-2 Demonstrate Use of Self Rescuer
SC 2-3-3 Demonstrate Use of Fire Extinguisher
SC 2-3-4 Demonstrate the Barricading Method of Self Rescue
D. First Aid
SC 2-4-1 Artifical Respiration
SC 2-4-2 Treatment for Shock
SC 2-4-3 Treatment of Burns
SC 2-4-4 Dressing for Fractures and Dislocations
SC 2-4-5 Control of Bleeding
SC 2-4-6 Use of Bandages
SC 2-4-7 Moving and Handling Victim
SC 2-4-8 Immobilize Victim on Body Board

E. Instruments
SC 2-5-1 Disassemble and Assemble Flame Safety Lamp
SC 2-5-2 Clean, Adjust and Fill Flame Safety Lamp
SC 2-5-3 Light and Calibrate Flame Safety Lamp
SC 2-5-4 Check and Recharge Battery
SC 2-5-5 Check and Adjust Electrical Zero

Unit III - Internal Mine Construction
A. Roof Control
SC 3-1-1 Test and Scale Roof
SC 3-1-2 Set Props on Floor
SC 3-1-3 Install Crossbars and Beams
SC 3-1-4 Construct Cribs
SC 3-1-5 Bolt a Roof

INFORMATION LESSONS

B. Mine Gases
IL 2-2-1 Normal Atmospheric Gases
IL 2-2-2 Methane
IL 2-2-3 Carbon Monoxide
IL 2-2-4 Rare Gases
IL 2-2-5 Mine Damp

C. Fires and Explosions
IL 2-3-1 Preventing Ignition of Fires
IL 2-3-2 Conveyor Belt Protection
IL 2-3-3 Fighting Fires
IL 2-3-4 Use of the Self Rescuer
IL 2-3-5 Explosion Hazards
D. First Aid
IL 2-4-1 Artifical Respiration
IL 2-4-2 Pressure Points
IL 2-4-3 Stop or Control of Bleeding
IL 2-4-4 Treating for Shock
IL 2-4-5 Bandages for Wounds and Burns
IL 2-4-6 Fractures and Dislocations
IL 2-4-7 Types of Bandages
IL 2-4-8 Handling and Moving Patients
E. Instruments
IL 2-5-1 Development of the Flame Safety Lamp
IL 2-5-2 Maintaining the Flame Safety Lamp
IL 2-5-3 Using the Flame Safety Lamp
IL 2-5-4 Types of Methane Measuring Instruments
IL 2-5-5 Measuring Methane Traces
IL 2-5-6 Continuous Methane Monitoring
IL 2-5-7 Nitrogen Dioxide Detector
IL 2-5-8 Hydrogen Sulphide Detector

Unit III - Internal Mine Construction
IL 3-1-1 Loads on Roofs
IL 3-1-2 Testing and Scaling Roofs
IL 3-1-3 Setting Props
IL 3-1-4 Crossbars and Other Beams
IL 3-1-5 Crib Building
IL 3-1-6 Erecting Temporary Roof Supports

SKILL COMPETENCIES/OPERATIONS

B. Ventilation Structures
SC 3-2-1 Install Supports for Brattice & Tubing
SC 3-2-2 Install Ventilation Tubes & Couplings
SC 3-2-3 Construct Masonary Stoppings
SC 3-2-4 Erect Metal Stoppings
SC 3-2-5 Seal Masonary and Metal Stoppings
SC 3-2-6 Construct Concrete and Metal Stoppings

C. Track & Trolley Layout
SC 3-3-1 Prepare a Roadbed with Uniform Grades
SC 3-3-2 Align Tracks on Roadbed
SC 3-3-3 Space, Spike and Join Track
SC 3-3-4 Install Switches
SC 3-3-5 Maintain Tracks & Trolleys in a Safe Manner
SC 3-3-6 Install Trolley Wire

D. Water Control
SC 3-4-1 Operate A Pump
SC 3-4-2 Install Pumps
SC 3-4-3 Preventive Maintenance of Pumps
SC 3-4-4 Installing Piping

Unit IV - Mining Procedures, Machinery and Equipment
SL 4-1-1 Use a Dynamite Punch
SL 4-1-2 Secure Wires to a Primer Cartridge
SL 4-1-3 Charge JA Tap Hole
SL 4-1-5 Tamp A Drill Hole
SL 4-1-5 Fabricate A Series Of Firing Circuits
SL 4-1-6 Test a Series Circuit
SL 4-1-7 Lubricate Mining Machines
SL 4-1-8 Bottom Cut a Face with a Cutting Machine
SL4-1-9 Drill a Predetermined Face Pattern
SL 4-1-10 Operate a Loading Machine
SL 4-1-11 Load and Discharge a Shuttle Car
SL 4-1-12 Operate a Roof Bolter
SL 4-1-13 Complete A mining Cycle with a Continuous Miner
SL 4-1-14 Operate a Belt Conveyor
SL 4--1-15 Operate Locomotives
SL 4-1-16 Operate A Scoop

INFORMATION LESSONS
IL 3-1-7 Roof Bolting
IL 3-1-8 Roof Bolting Plans
IL 3-1-9 Hazards and Protection

B. Ventilation Structures
IL 3-2-1 Brattice and Tubing
IL 3-2-2 Masonary and Metal Stoppings
IL 3-2-3 Construction of Overcasts

C. Track & Trolley Layout
IL 3-3-1 Laying Track
IL 3-3-2 Switches and Frogs
IL 3-3-3 Derailers and other Accessories
IL 3-3-4 Maintaining Tracks and Trolleys
IL 3-3-5 Installing Trolley Wire
IL 3-3-6 Electrical Resistance of Wire and Track
IL 3-3-7 Hazards and Safety of Tracks and Trolleys

D. Water Control
IL 3-4-1 Sources of Water in the Mines
IL 3-4-2 Plan of Water Removal
IL 3-4-3 Gathering Pumps
IL 3-4-4 Main Pumps
IL 3-4-5 Pipelines
IL 3-4-6 Treatment Ponds

Unit IV - Mining Procedures, Machinery and Equipment
IL 4-1-1 Development of Mining Explosives
IL 4-1-2 Modern INdustrial Explosives
IL 4-1-3 Detonating Explosives
IL 4-1-4 Primers
IL 4-1-5 Charging, Tamping and Firing
IL 4-1-6 Firing Circuits
IL 4-1-7 Safety Precautions During Blasting
IL 4-1-8 Introduction to Universal Cutting Machines
IL 4-1-9 Introduction to a Face Drill
IL 4-1-10 Introduction to Loading Machines
IL 4-1-11 Introduction to Shuttle Cars
IL 4-1-12 Introduction to Roof Bolters
IL 4-1-13 Introduction to Continuous Miners

SKILL COMPETENCIES/OPERATIONS

Unit V - Mine Mechanical Maintenance

A. Interpreting Engineering Drawings

SC 5-1-1 Draw Orthographic Projections
SC 5-1-2 Draw Auxiliary Views
SC 5-1-3 Draw Section Views
SC 5-1-4 Draw Break Conventions
SC 5-1-5 Redraw Structural Details

B. Oxyacetylene Maintenance Welding

SC 5-2-1 Adjust Torch for Neutral Flame
SC 5-2-2 Produce Beads by Puddling
SC 5-2-3 Join Two Pieces with an Outside Corner Joint Weld
SC 5-2-4 Perform a Flange Weld Without Rod
SC 5-2-5 Lap Weld an Outside Corner
SC 5-2-6 Joint Weld an OUtside Corner

C. Oxyacetylene Cutting

SC 5-3-1 Setup Equipment for Cutting
SC 5-3-2 Cut Steel of 1/8-inch thick or less
SC 5-3-3 Cut Steel of 1/8-inch thick or more
SC 5-3-4 Cut Ferrous Alloy Metals

D. Direct Current Welding

SC 5-4-1 Adjust and Start Arc Welding Machine
SC 5-4-2 Produce an Arc
SC 5-4-3 Manipulate the Electrode in Various Arcs
SC 5-4-4 Lay Arc Beads
SC 5-4-5 Arc Weld an Edge Joint
SC 5-4-6 Arc Weld a Butt Joint
SC 5-4-7 Arc Weld a Lap Joint
SC 5-4-8 Arc Weld a Corner Joint

INFORMATION LESSONS

IL 4-1-14 Introduction to Conveyors
IL 4-1-15 Introduction to Locomotives and Trolleys
IL 4-1-16 Introduction to Dumps and Scoops

Unit V - Mine Mechanical Maintenance

A. Interpreting Engineering Drawings

IL 5-1-1 Perspective Drawing
IL 5-1-2 Isometric Drawing
IL 5-1-3 Orthographic Projection Drawing
IL 5-1-4 Conventions in Orthographic Projection
IL 5-1-5 Interpreting Machine Drawings
IL 5-1-6 Drawings for Repairs and Ordering Parts

B. Oxyacetylene Maintenance Welding

IL 5-2-1 Oxyacetylene Welding and Cutting Theory
IL 5-2-2 Oxyacetylene Welding Equipment
IL 5-2-3 Torch Adjustments
IL 5-2-4 Torch Positons and Movements
IL 5-2-5 Puddling
IL 5-2-6 Welds Without Welding Rod
IL 5-2-7 Types of Oxyacetylene Welds Made with Welding Rod
IL 5-2-8 Welding Rod and Selection of Rod Size
IL 5-2-9 Welding Positions
IL 5-2-10 Backhand Welding
IL 5-2-11 Multi-layer Welding
IL 5-2-12 Welding Safety

C. Oxyacetylene Cutting

IL 5-3-1 Oxyacetylene Cutting Process
IL 5-3-2 Cutting Thin Steel
IL 5-3-3 Cutting Thick Steel
IL 5-3-4 Cutting Ferrous Alloy Metals
IL 5-3-5 Safety in Oxyacetylene Cutting

D. Direct Current Welding

IL 5-4-1 Fundamentals of DC Arc Welding
IL 5-4-2 Safety Protective Clothing and Shielding
IL 5-4-3 Adjusting and Starting Arc Welding Machines
IL 5-4-4 Selecting the Electrode
IL 5-4-5 Striking an Arc
IL 5-4-6 Electrode Motions

SKILL COMPETENCIES/OPERATIONS	INFORMATION LESSONS
	IL 5-4-7 Running Metal Arc Bead on Flat Surface IL 5-4-8 Types of Joints IL 5-4-9 Position of Welds IL 5-4-10 Arc Blow IL 5-4-11 Undercutting IL 5-4-12 Safety in Electric Arc Welding
E. Alternating Current Welding SC 5-5-1 Prepare Metal SC 5-5-2 Start a Wald SC 5-5-3 Restart a Weld SC 5-5-4 Stop a Weld	E. Alternating Current Welding IL 5-5-1 Characteristics of AC Arc Welding IL 5-5-2 Advantages of AC Arc Welding IL 5-5-3 Generator Type AC Arc Welding IL 5-5-4 Transformer AC Arc Welding IL 5-5-5 Starting an AC Transformer Arc Welder IL 5-5-6 Striking an AC Arc IL 5-5-7 Alternating Current Arc Welding Safety
F. Mechanics & Machines SC 5-6-1 Calculate Work SC 5-6-2 Calculate Power SC 5-6-3 Calculate Efficiency SC 5-6-4 Calculate Friction Rates	F. Mechanics & Machines IL 5-6-1 Kinds of Forces IL 5-6-2 Work, Power, Efficiency and Friction Calculations IL 5-6-3 Basic Machines and Mechanical Advantage IL 5-6-4 Calculation and Application of Newtons' Law
G. Gears and Bearings SC 5-7-1 Install Gears SC 5-7-2 Install Bearings SC 5-7-3 Adjust and Align Gears SC 5-7-4 Preload and Shim Bearings	G. Gears and Bearings IL 5-7-1 Types of Gears IL 5-7-2 Types of Bearings IL 5-7-3 Installation of Gears and Bearings IL 5-7-4 Inspection Checks on Gears and Bearings IL 5-7-5 Preloading and Shimming Bearings IL 5-7-6 Adjusting and Aligning Gears IL 5-7-7 Safety Procedures
H. Chains and Sprockets SC 5-8-1 Calculate Flight Conveyor Speeds SC 5-8-2 Adjust and Align Flight Conveyors and Chains	H. Chains and Sprockets IL 5-8-1 Calculate Speed IL 5-8-2 Types of Chains, Sprockets and Flight Conveyors IL 5-8-3 Inspection Checks IL 5-8-4 Adjustment and Alignment Procedures IL 5-8-5 Safety Procedures
I. Couplings and Driveshafts SC 5-9-1 Install and Remove Shafts and Couplings SC 5-9-2 Gauge Alignment	I. Couplings and Driveshafts IL 5-9-1 Types of Shafts and Couplings IL 5-9-2 Installation and Removal

SKILL COMPETENCIES/OPERATIONS

J. Mine Mechanical Units
SC 5-10-1 Disassemble a Gathering Head Reducer
SC 5-10-2 Disassemble a Traction Reducer
SC 5-10-3 Disassemble a Conveyor Drive Reducer
SC 5-10-4 Disassemble Steering and Drag Link Assemblys

Unit VI - Hydraulics
SC 6-1-1 Interpret Pressure Gauge
SC 6-1-2 Interpret Flow Meter
SC 6-1-3 Measure Weight with a Scale
SC 6-1-4 Measure Linear Distance
SC 6-1-5 Measure Time

Unit VII - Electricity
A. Elements of Electricity
SC 7-1-1 Build a Model Atom
SC 7-1-2 Demonstrate Insulators and Conductors
SC 7-1-3 Show Magnetic Lines of Flux
SC 7-1-4 Demonstrate "Rule of Left Hand"
SC 7-1-5 Magnetic Force in a Coil
SC 7-1-6 Elements of a Circuit
SC 7-1-7 Series and Parallel Batteries
B. Basic AC Circuits
SC 7-2-1 Design and Build a Light Circuit
SC 7-2-2 Design and Build a Motor Circuit
SC 7-2-3 Design and Build a Motor Holding Circuit
SC 7-2-4 Design a Holding Circuit and Control Circuit
SC 7-2-5 Design and Build a Circuit with a Panic Switch
SC 7-2-6 Design and Build a Circuit with Overload Protection
SC 7-2-7 Troubleshoot a Circuit
SC 7-2-8 Identify Wiring Diagram Symbols
SC 7-2-9 Identify Electrical Components
SC 7-2-10 Draw Elementary & Schematic Diagrams
SC 7-2-11 Demonstrate Switches
SC 7-2-12 Demonstrate Fuse, Circuit Breaker and Overload
SC 7-2-13 Disassemble a Linestarter
SC 7-2-14 Demonstrate Troubleshooting Techniques

INFORMATION LESSONS

IL 5-9-3 Visual Inspection and Instrument Gauging
IL 5-9-4 Alignment and Wear
IL 5-9-5 Safety Procedures
J. Mine Mechanical Units
IL 5-10-1 Removal, Adjustment and Repair of Head Pots
IL 5-10-2 Removal, Adjustment and Repair of Traction Drive
IL 5-10-3 Removal, [illegible]justment and Repair of Conveyor Drive
IL 5-10-4 Removal, Adjustment and Repair of Reducers
IL 5-10-5 Removal, Adjustment and Repair of Drag Link Assemblys
IL 5-10-6 Safety Precautions

Unit VI - Hydraulics
IL 6-1-1 Pascal's Law
IL 6-1-2 Bournillie's Law
IL 6-1-3 Four Basic Pumps

Unit VII - Electricity
A. Elements of Electricity
IL 7-1-1 Electron Theory
IL 7-1-2 Theory of Dynamic Electricity
IL 7-1-3 Kinds of Electricity
IL 7-1-4 Hazards of Static Electricity

B. Basic AC Circuits
IL 7-2-1 Differentiate Between Voltage, Ampere and Ohm
IL 7-2-2 Basic Circuit Terminology
IL 7-2-3 Series and Parallel Circuits
IL 7-2-4 Differentiate Between DC and AC Electricity
IL 7-2-5 High Voltage Safety Precautions

SKILL COMPETENCIES/OPERATIONS

C. Direct Current Mining Machinery

SC 7-3-1 Identify Symbols
SC 7-3-2 Identify Components
SC 7-3-3- Replace Contact Tips
SC 7-3-4 Adjust Tip Wire
SC 7-3-5 Check Motor Coils
SC 7-3-6 Adjust Motor Brushes
SC 7-3-7 Trace Circuit
SC 7-3-8 Develop Sequence Chart

D. AC Mining Machinery

SC 7-4-1 Identify Wiring Diagram Symbols
SC 7-4-2 Disassemble AC Motor
SC 7-4-3 Determine Lead Marking
SC 7-4-4 Check Stator and Rotor Windings
SC 7-4-5 Check Bearings
SC 7-4-6 Remove Controller Case Cover
SC 7-4-7 Remove Control Panel
SC 7-4-8 Repair Linestarter
SC 7-4-9 Check Time Delay Devices
SC 7-4-10 Check Trailing Cable
SC 7-4-11 Splice Trailing Cable

E. Permissibility

SC 7-5-1 Use a Feeler Gauge
SC 7-5-2 Check Plane Flange Joint
SC 7-5-3 Check Step Flange Joint
SC 7-5-4 Check Threaded Joint
SC 7-5-5 Check Cylindrical Joint
SC 7-5-6 Stuff a Packing Gland

F. AC/DC Mining Machines

SC 7-6-1 Demonstrate Diode Bridge
SC 7-6-2 Determine Direction of Current Flow Through a Diode
SC 7-6-3 Take Voltage Readings on Logic Box
SC 7-6-4 Use Logic Box Tester

G. SCR Mining Machines

SC 7-7-1 Identify an SCR
SC 7-7-2 Demonstrate SCR in DC Circuit
SC 7-7-3 Demonstrate SCR in AC Circuit

INFORMATION LESSONS

C. Direct Current Mining Machinery

IL 7-3-1 Theory and Design of DC Motors
IL 7-3-2 Calculation of Horsepower, and Efficiency of DC Motors
IL 7-3-3 Wiring DC Motors
IL 7-3-4 Diagnosing DC Motor Malfunctions
IL 7-6-5 Maintaining Explosion Proof Motors
IL 7-3-6 Safety Precautions

D. AC Mining Machinery

IL 7-4-1 Maintaining Manual or Automatic Starters
IL 7-4-2 Contactors
IL 7-4-3 Stages of Resistance Starting
IL 7-4-4 Maintenance of Contactors
IL 7-4-5 Safety Procedures
IL 7-4-6 Theory of AC Current
IL 7-4-7 Calculating Hrosepower and Efficiency
IL 7-4-8 Advantages and Disadvantages of AC, DC, and AC/DC
IL 7-4-9 Trailing and Transmission Cables
IL 7-4-10 Repair of Cable
IL 7-4-11 Splicing Trailing Cable
IL 7-4-12 Testing Cable for Shorts
IL 7-4-13 Testing Cable and Safety

E. Permissibility

IL 7-5-1 Permissibility and Mining Equipment
IL 7-5-2 Explosion Proof Casings and Compartments
IL 7-5-3 Gauging Compartments
IL 7-5-4 Seals and Packing Glands
IL 7-5-5 Safety Precautions

F. AC/DC Mining Machines

IL 7-6-1 Size of Wire and Cable
IL 7-6-2 Resistance Tables of Wire and Cable
IL 7-6-3 Advantages and Disadvantages of AC and DC TRansmission Cables in Mining
IL 7-6-4 Calculating Voltage and Power Losses
IL 7-6-5 INstallation and Maintenance of Cable
IL 7-6-6 Safety and High Voltage Cables

G. SCR Mining Machines

IL 7-7-1 Basic SCR Theory
IL 7-7-2 Application of SCR to Control Systems
IL 7-7-3 Repair of SCR Components
IL 7-7-4 Troubleshooting System Malfunctions

WRITTEN INSTRUCTIONAL AIDS

Introduction

Instruction sheets are aids used in developing the most effective and efficient teaching-learning situation that is possible. Four types of sheets are generally used including job sheets, operation sheets, information sheets and assignment sheets.

The JOB involves a sequential performance of operations by the learner to "tryout" and develop the skill competencies (operations) of the occupation resulting in a product or service. It is the vehicle of instruction or the media by which the student practices and develops a series of skill competencies (operations). JOB SHEETS indicate to the studnet WHAT to do in performing the various jobs assigned by the instructor. The jobs that will be used as vehicles of the instruction in the course are listed in the COURSE OUTLINE section.

OPERATIONS are the subdivisions in the breakdown of a job. Each operation represents a process, way of doing or how to perform the particular skill competency or operation.

OPERATION SHEETS supplement the job sheets and indicate to the student how to perform the many skill competency operations necessary to complete the assigned jobs. The operations that will be taught in the course are listed in the COURSE OUTLINE section under skill competencies/operatons. The operation sheets should be numbered to correspond with the skill competencies listed in the course outline.

INFORMATION SHEETS supplement the job sheets and provide the student with information necessary for completing the assigned jobs with highest possible degree of understanding. The information units that will be stressed in the course are listed in the course outline under information lessons. The information sheets included in this section should be numbered to correspond with the information lessons listed in the course outline.

ASSIGNMENT SHEETS supplement the job sheets and provide the student with mental activities necessary to learn the "knowing" that accompanies the "doing" of the trade. The student is assigned related studies or technical information to be "sought out" by the studnet on an individual basis through the use of problems or "exercises".

JOB: Develop Ventilation plan for seven entry section **JOB NUMBER:** J - 2A - 1

UNIT: II-A Ventilation

COURSE: Mine Equipment Maintenance

MATERIAL: Worksheet, Colored Pencils

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Show intake and return entries. 2. Show location of necessary ventilation equipment including stoppings, check curtains, line curtains, overcasts, regulators, mandoors. 3. Show location of fresh air, belt and track entries. 4. Calculate air flow necessary for the section.	SC 2 - 1 - 1 SC 2 - 1 - 2

METHOD OF EVALUATION: Accurary of Ventilation Plan

JOB NUMBER: J - 2A - 2

JOB: Lay out ventilation in model mine

UNIT: 11-A Ventilation

COURSE: Mine Equipment Maintenance

MATERIAL: Table Top Mine Training Model

EQUIPMENT:

SAFETY PRECAUTIONS: Good ventilation in room to clear smoke

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Install ventilation equipment as shown on plan. 2. Blow smoke through mine. 3. Observe flow patterns of smoke and note effectiveness of plan. 4. Modify plan if necessary to correct for areas of low air flow.	SC 2 - 1 - 1 SC 2 - 1 - 2

METHOD OF EVALUATION: Effectiveness of Ventilation Technique

JOB: Measure Air Flow Across Coal Face

JOB NUMBER: J - 2A - 3

UNIT: II-A Ventilation

COURSE: Mine Equipment Maintenance

MATERIAL: Paper & Pencil

EQUIPMENT: Vane Anemometer

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Determine best place to take measurement.	
2. Measure velocity with Vane Anemometer.	SC 2 - 1 - 3
3. Calculate area of entry.	SC 2 - 1 - 4
4. Calculate air flow	

METHOD OF EVALUATION: Technique of Measurement
Method of Calculation
Accuracy of Calculation

JOB: Identify Poisonous Gases

JOB NUMBER: J - 2B - 1

UNIT: IIB Mine Gases

COURSE: Mine Equipment Maintenance

MATERIAL: Paper & Pencil

EQUIPMENT: Gas Detectors

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. List poisonous gases found in mine air.	SC 2 - 2 - 1
2. Demonstrate the method used to detect each gas listed.	SC 2 - 2 - 2
3. Explain the action to be taken to remove the gas.	SC 2 - 2 - 4

METHOD OF EVALUATION:
Complete list
Demonstration
Correct action

JOB: Identify Explosive Gases **JOB NUMBER:** J - 2B - 2

UNIT: IIB Mine Gases

COURSE: Mine Equipment Maintenance

MATERIAL: Paper & Pencil

EQUIPMENT: Methane Detectors, Gas Chamber, Methane Gas

SAFETY PRECAUTIONS: Good ventilation in room. No smoking or open flames

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. List explosive gases found in mine air, and their explosive ranges.	SC 2 - 2 - 1
2. Demonstrate use of detecting device.	SC 2 - 2 - 3
3. Explain action to be taken in the event explosive gas is found.	SC 2 - 2 - 4

METHOD OF EVALUATION: Complete list
Demonstration
Correct action.

JOB: Locate Fire Protection Equipment **JOB NUMBER:** J - 2C - 1

UNIT: II-C Fires & Explosions

COURSE: Mine Equipment Maintenance

MATERIAL: Model Mine, Paper & Pencil

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Show in the model mine the location of all equipment working on the section. 2. List all the potential fire hazards. 3. List the precautions to take for each hazard. 4. Show the location of - Fire extinguishers - Rock dust - Explosives storage - First Aid Kit & Stretcher - Barricading materials - Hydraulic oil & lubricants - Power center - Excapeways	SC 2 - 3 - 1 SC 2 - 3 - 2 SC 2 - 3 - 4 SC 2 - 3 - 5 SC 2 - 3 - 6

METHOD OF EVALUATION: List of hazards
Precautions taken
Location of items

JOB: Show Method of Rescue **JOB NUMBER:** J - 2C - 2

UNIT: II - C Fires & Explosions

COURSE: Mine Equipment Maintenance

MATERIAL: Model Mine, Self Rescuer, Fire Extinguishers

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
Given a hypothetical situation in the mine model - 1) determine location, size, type of fire 2) put on self rescuer 3) extinguish fire or 4) leave area for fresh air 5) barridace self in safe place and wait for rescue	SC 2 - 3 - 1 SC 2 - 3 - 2 SC 2 - 3 - 3 SC 2 - 3 - 4 SC 2 - 3 - 5 SC 2 - 3 - 6

METHOD OF EVALUATION: Correct identification of fire
Use of self rescuer
Correct action

JOB: Treat Victim of Electrical Shock **JOB NUMBER:** J - 2D - 1

UNIT: II - D First Aid

COURSE: Mine Equipment Maintenance

MATERIAL: Dressings
Bandanges

EQUIPMENT: Stretcher

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Shut off electricity	SC 2 - 4 - 1
2) Check for breathing	SC 2 - 4 - 2
3) Administer artificial respiration	SC 2 - 4 - 3
4) Treat victim for shock	
5) Treat burns	
6) Remove victim to emergency medical facility	

METHOD OF EVALUATION:

Order of treatment
Correct treatment
Technique used in treatment

JOB: Treat Compound Fracture **JOB NUMBER:** J - 2D - 2

UNIT: II - D First Aid

COURSE: Mine Equipment Maintenance

MATERIAL: Dressing
Bandages
Splint Material

EQUIPMENT: Stretcher

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Keep victim calm	SC 2 - 4 - 2
2) Stop bleeding	SC 2 - 4 - 4
3) Immobilize broken bone	SC 2 - 4 - 5
4) Apply splint	SC 2 - 4 - 6
5) Treat for shock	
6) Remove victim to emergency medical facility	

METHOD OF EVALUATION:

Order of treatment
Correct treatment
Techniques used

JOB: Treat Severe Lacerations **JOB NUMBER:** J - 2D - 3

UNIT: II - D First Aid

COURSE: Mine Equipment Maintenance

MATERIAL: Dressing
Bandages

EQUIPMENT: Stretcher

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Calm victim	SC 2 - 4 - 2
2) Stop bleeding	SC 2 - 4 - 4
3) Apply dressing and bandages	SC 2 - 4 - 5
4) Treat for shock	SC 2 - 4 - 6
5) Remove victim to emergency medical facility	SC 2 - 4 - 7

METHOD OF EVALUATION:

Order of treatment
Correct treatment
Techniques used

JOB: Treat Head & Neck Injury **JOB NUMBER:** J - 2D - 4

UNIT: II - D First Aid

COURSE: Mine Equipment Maintenance

MATERIAL: Bandages
Straps

EQUIPMENT: Body Board

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Calm victim	SC 2 - 4 - 2
2) Determine how injury occurred	SC 2 - 4 - 4
3) Immobilize victim	SC 2 - 4 - 6
4) Treat for shock	SC 2 - 4 - 7
5) Transfer victim to body board and secure for transporting	SC 2 - 4 - 8
6) Remove victim to emergency medical facility	

METHOD OF EVALUATION:

Order of treatment
Correct treatment
Techniques used

JOB: Maintain Flame Safety Lamp **JOB NUMBER:** J - 2E - 1

UNIT: II - E Instruments

COURSE: Mine Equipment Maintenance

MATERIAL: Naptha
Flints

EQUIPMENT: Flame Safety Lamp
Magnet
Low Pressure Air Gun
Soft Bass Bristle Brush

SAFETY PRECAUTIONS: 1) No smoking or open flame near fuel supply
2) Care must be taken not to damage parts

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Disassemble Flame Safety Lamp	SC 2 - 5 - 1
2) Inspect all pieces for wear or damage	SC 2 - 5 - 2
3) Clean igniter, wick and gauze	SC 2 - 5 - 3
4) Replace flint	
5) Fill fuel font	
6) Re-assemble lamp	
7) Light lamp and adjust flame in fresh air	
8) Test in gas chamber	

METHOD OF EVALUATION: Proper maintenance techniques
Ability to perform all steps
Care used in filling and reassembling

JOB: Maintain Methane Detector **JOB NUMBER:** J - 2E - 2

UNIT: II - E Instruments

COURSE: Mine Equipment Maintenance

MATERIAL: Methane Detector
Methane Gas

EQUIPMENT: Screwdriver
Battery Charger
Test Chamber

SAFETY PRECAUTIONS: Be careful with methane gas. No smoking or open flame.
Work in well ventilated area.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Check mechanical zero	SC 2 - 5 - 4
2) Check Battery voltage	SC 2 - 5 - 5
3) Charge battery	SC 2 - 5 - 6
4) Check electrical zero	
5) Take gas reading in known concentration of methane to check methane detector	

METHOD OF EVALUATION:

JOB: Maintain Bulb Type Gas Detector **JOB NUMBER:** J - 2E - 3

UNIT: II - E Instruments

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Bulb Type Gas Detector

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Examine bulb to see if it is in good condition 2) Test detector tube outlet valve by squeezing bulb and putting finger over opening. Bulb should remain flat. 3) Test bulb outlet valve by putting finger over valve and squeezing bulb. Bulb should remain full or air.	IL 2 - 5 - 7

METHOD OF EVALUATION:

JOB: Design a Roof Control Plan for Entries and Intersections **JOB NUMBER:** J - 3A - 1

UNIT: Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale Entry and Intersection Schematic, transparency material and grease pencil

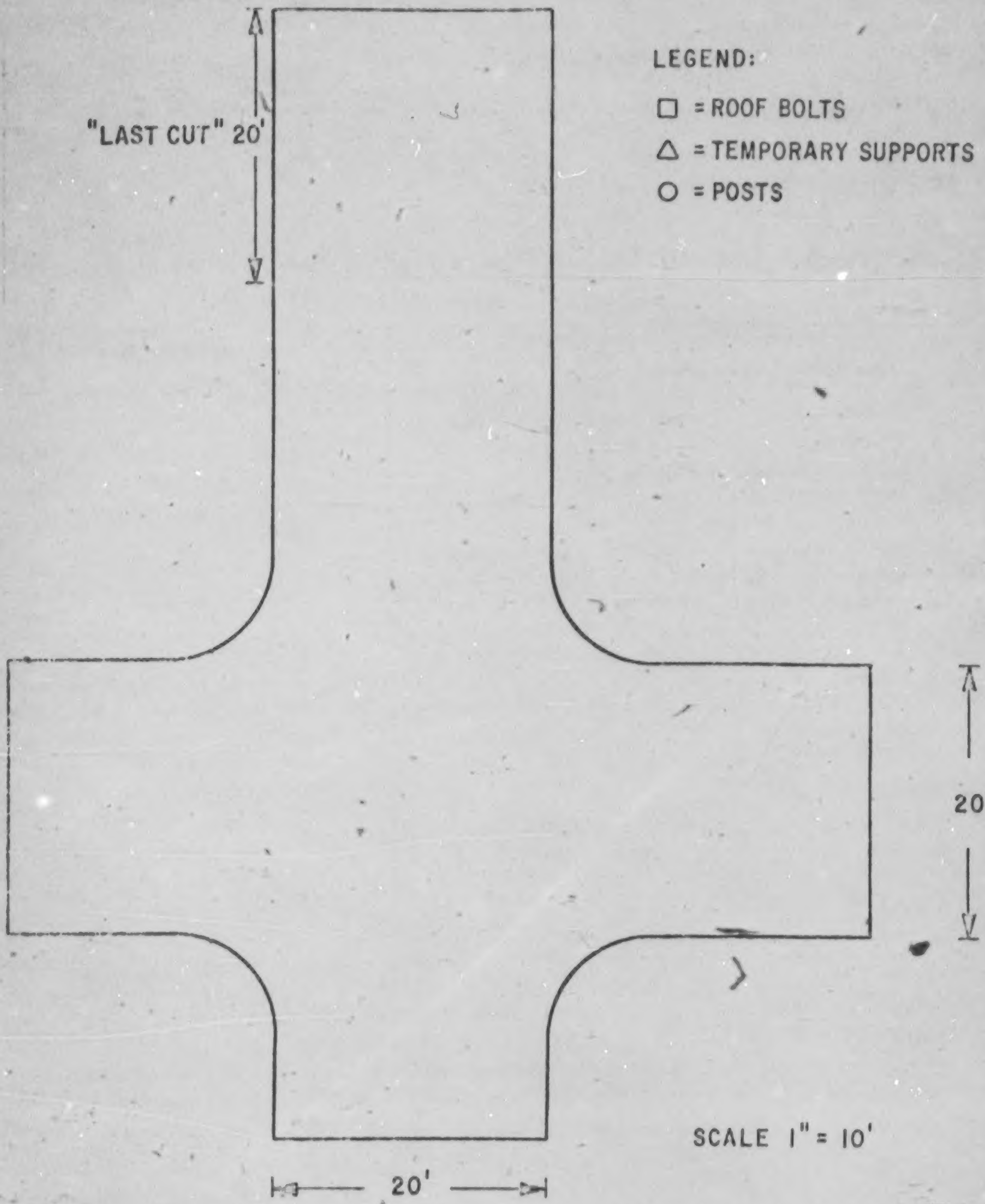
EQUIPMENT: Optional Table Top Mine

SAFETY PRECAUTIONS: Insure each student is aware of the grave danger of entering any portion of a mine with an unsupported roof.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Install roof bolts in entries and an intersection as close as possible, but no more than five feet apart. Normal practice is to install them on four foot centers. 2. Install temporary roof supports in the "Last cut", no further than 20 feet from the face. 3. Place the temporary roof supports in the following, specific sequence: one row at the left on four foot centers after the first pass (based upon 20 foot wide entries). Upon completion of the second pass, place 3 more rows of four temporary roof bolts to adequately support the roof. 4. Place permanent roof bolts in the temporary supported roof area.	Note: A diagram of a scale entry and intersection portion of a mine is located on the back of this page. It can be used as a resource for the students to design the roof control plan in this job.

METHOD OF EVALUATION:

The student will detail on transparency material placed over the scale entry and intersection schematic the location of roof bolts and temporary supports by making proper symbols with a grease pencil.


"LAST CUT" 20'
LEGEND:
□ = ROOF BOLTS
△ = TEMPORARY SUPPORTS
○ = POSTS
20'
SCALE 1" = 10'
20'

JOB: Design a roof control plan using a combination of roof bolts and timbers to allow entry widths exceeding 20 feet. **JOB NUMBER:** J - 3A - 2

UNIT: Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale entry and intersection schematic, transparency material and grease pencil.

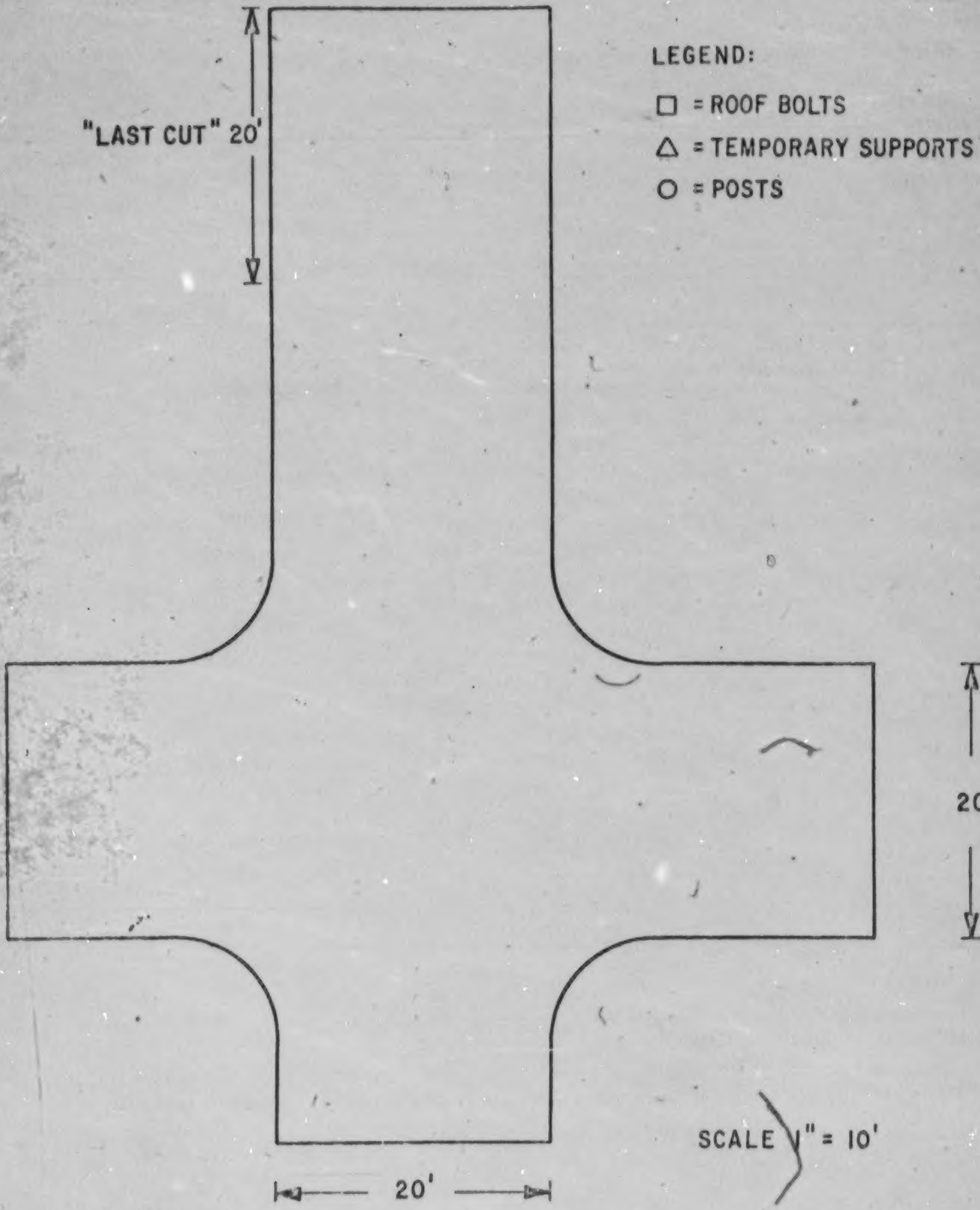
EQUIPMENT: Optional table top mine

SAFETY PRECAUTIONS: Guard against personnel entering an unsupported roof portion of a mine.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set timbers or posts for each 5 feet of space between the roadway posts and one side of the rib. Openings should not exceed 30 feet. 2. Place roof bolts on four foot center up to within 20 feet of the last cut. 3. Install additional posts along the curved ribs at intersections instead of roof bolts. 4. Set four temporary roof supports on four foot centers beginning at the outby section of the first cut. 5. Install 3 more rows of temporary roof supports after the second pass. 6. Remove the temporary roof supports one at a time in the order they were placed and replace the first row with timbers and the remainder with roof bolts.	Operation Sheet SC 3 - 1 - 2 Operation Sheet SC 3 - 1 - 5 Note: A diagram of a scale entry and intersection portion of a mine is located on the back of this page. It can be used as a resource for the students to design the roof control plan in this job.

METHOD OF EVALUATION:

The student will detail on transparency material placed over the scale entry and intersection schematic the location of roof bolts and temporary supports by making proper symbols with a grease pencil.


"LAST CUT" 20'
LEGEND:
☐ = ROOF BOLTS
△ = TEMPORARY SUPPORTS
○ = POSTS
20'
20'
SCALE 1" = 10'

JOB: Design a roof control plan for bad roof areas of entries and intersections

JOB NUMBER: J - 3A - 3

UNIT: Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale entry and intersection schematic, transparency material and a grease pencil.

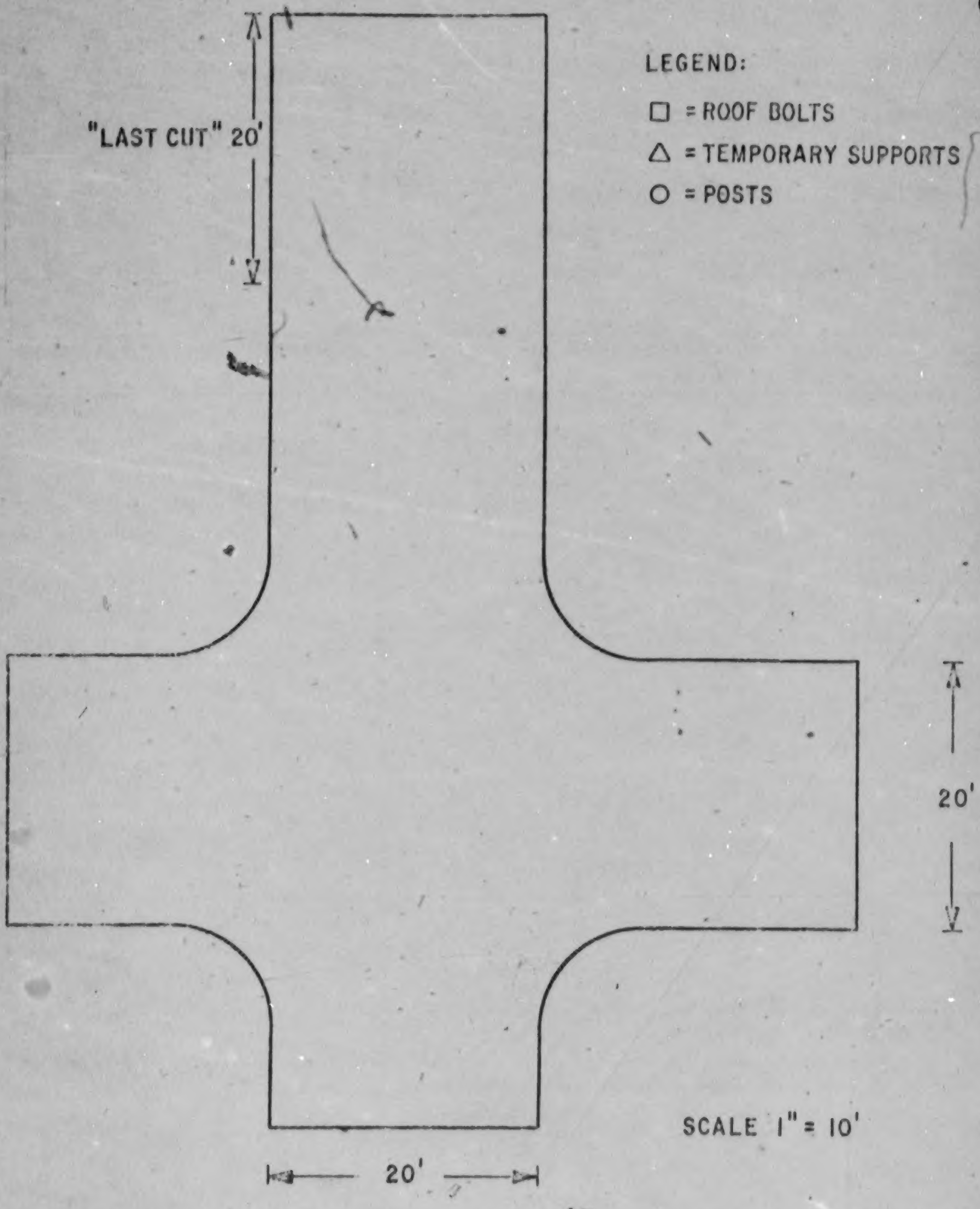
EQUIPMENT: Optional table top mine

SAFETY PRECAUTIONS: Guard against personnel entering an unsupported roof portion of a mine.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set posts at four foot intervals four feet out from the rib. 2. Place headers on top of the posts. The headers are 14 - 16 feet in length for an entry 16 - 22 feet wide. 3. Place wedges between the header and the two posts. 4. Bolt the headers on four foot centers using embossed bearing plates at least 4" x 6" x 3/8". 5. Insure that while working toward the face temporary roof supports or timbers are in place according to J - 3A - 2.	Operation Sheet SC 3 - 1 - 2 Operation Sheet SC 3 - 1 - 3 Operation Sheet SC 3 - 1 - 5 Note: A diagram of a scale entry and intersection portion of a mine is located on the back of this page. It can be used as a resource for the students to design the roof control plan in this job.

METHOD OF EVALUATION:

The student will detail on transparency material placed over the schematic the location of timbers, cross-bars, roof bolts, and temporary supports with a grease pencil.


"LAST CUT" 20'
LEGEND:
□ = ROOF BOLTS
△ = TEMPORARY SUPPORTS
○ = POSTS
20'
SCALE 1" = 10'
20'

JOB: Roof Control for Pillar Extraction **JOB NUMBER:** J - 3A - 4

UNIT: Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale pillar extraction schematic, transparency material and a grease pencil.

EQUIPMENT: Optional table top simulated mine

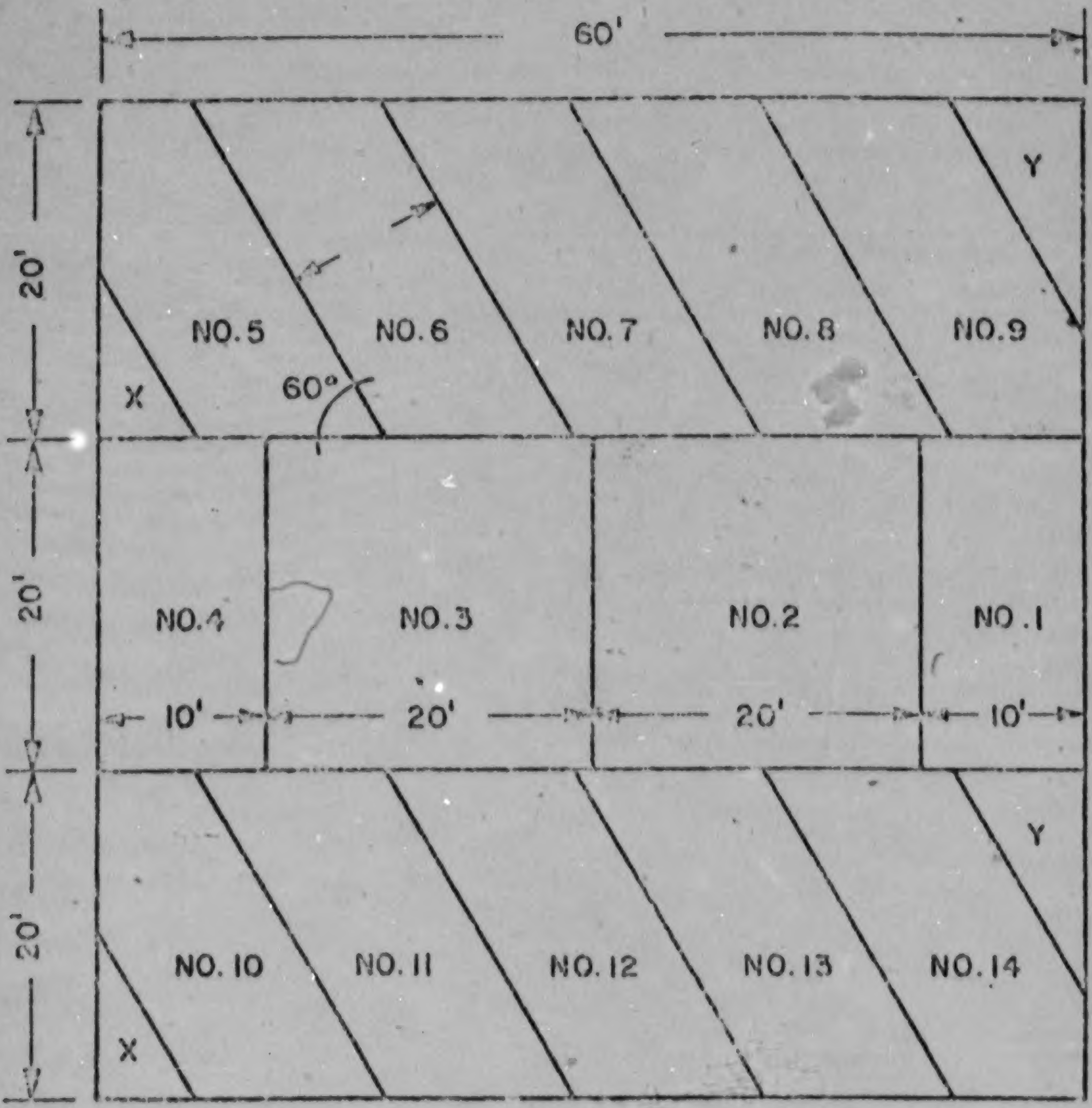
SAFETY PRECAUTIONS: Always guard against personnel entering an unsupported roof.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set temporary roof supports on four foot centers in the pocket on the pocketwing approach to pillar extraction. 2. Place permanent roof supports in the pocket in place of temporary supports from outby to the inby position. 3. Repeat this cycle as the continuous miner splits the pillar to complete the pocket or pillar split. 4. Set posts in the split for additional support prior to mining the wings. 5. Heavily timber the 10 foot lifts in the wing as the cycle continues. 6. Remove temporary supports in the upper wing upon completion of this portion of the cycle. 7. Repeat this cycle for the lower wing.	Operation Sheet SC 3 - 1 - 2 Operation Sheet SC 3 - 1 - 5 Note: A diagram of a scale pillar extraction schematic is located on the back of this page. It can be used as a resource for the student to design the roof control plan in this job. This is one of several plans that can be used for pillar extraction. Conditions may require additional support.

METHOD OF EVALUATION:

The student will detail on transparency material placed over the schematic the location of timbers, bolts and temporary support with a grease pencil.

PILLAR EXTRACTION PLAN
MODIFIED POCKET-WING SYSTEM


60'
20'
20'
20'
Y
NO.5
NO.6
NO.7
NO.8
NO.9
X
60°
NO.4
NO.3
NO.2
NO.1
10'
20'
20'
10'
Y
NO.10
NO.11
NO.12
NO.13
NO.14
X

X AND Y ARE REMAINING STUMPS OF COAL

JOB: Construction of a Blowing System with a Line Curtain **JOB NUMBER:** J - 3B - 1

UNIT: III - Internal Mine Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale entry and intersection schematic, transparency material and grease pencil

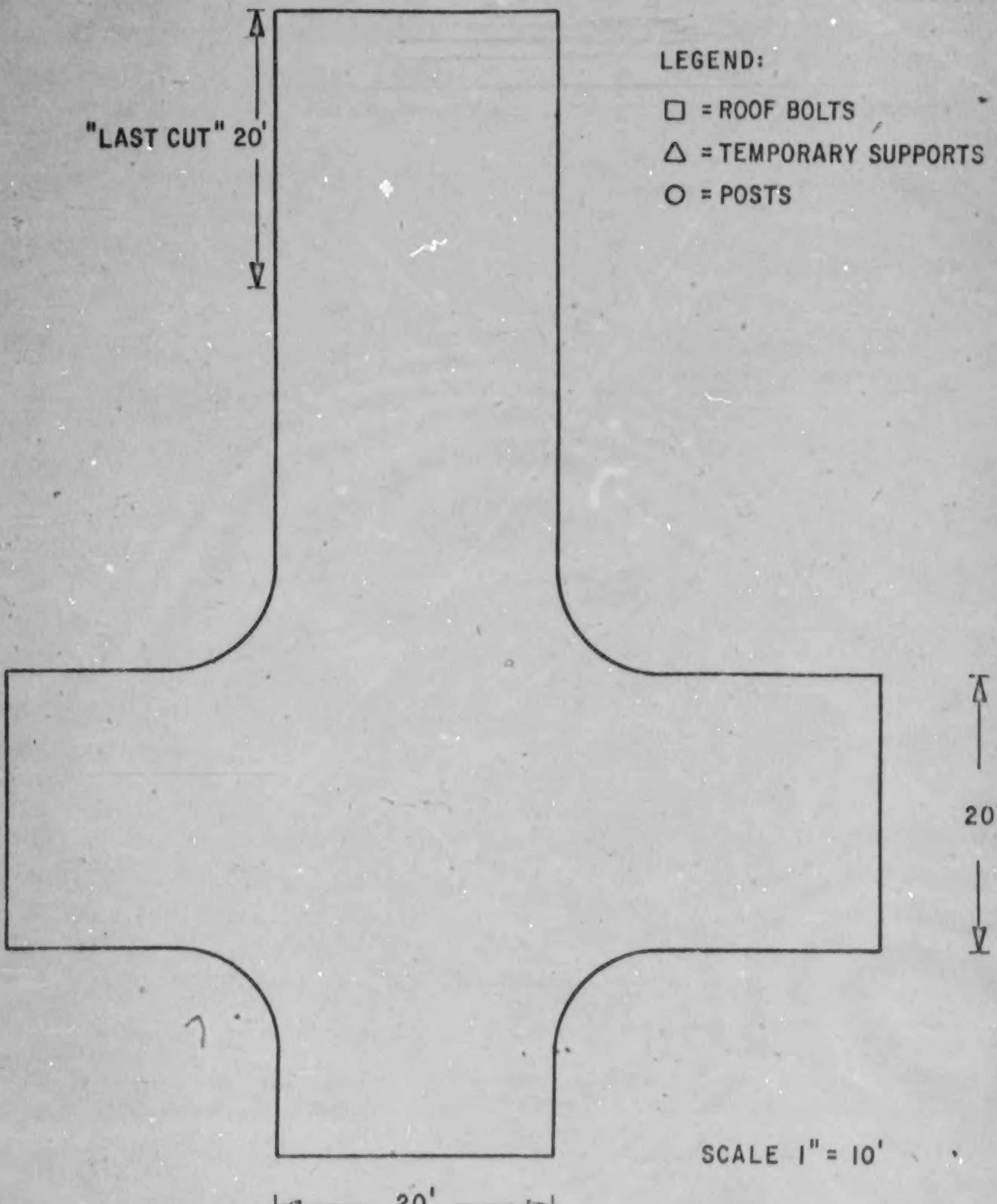
EQUIPMENT: Optional table top mine model

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Install a line curtain (brattice cloth next to the rib on the intake side	SL 3 - 2 - 1
2) Place line curtain three to four feet from the intake side rib.	
3) Extend the line curtain to within no less than 10 feet from the face.	
4) Insure the check curtain is installed outby the intersection rib. Take is, the check curtain is started at the right outby rib on the second and subsequent crosscuts. On the first, it is started from the left rib.	NOTE: The minimum quantity of air at the face is 3,000 cfm

METHOD OF EVALUATION:

The student will detail on transparency material placed over the scale entry and intersection. Schematic the placement of the line curtain with a grease pencil.


"LAST CUT" 20'
LEGEND:
□ = ROOF BOLTS
△ = TEMPORARY SUPPORTS
○ = POSTS
20'
SCALE 1" = 10'
20'

JOB: Construction of a Blowing System with Auxiliary Fans **JOB NUMBER:** J - 3B - 2

UNIT: III - Internal Mine Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale entry and intersection schematic, transparency material and a grease pencil.

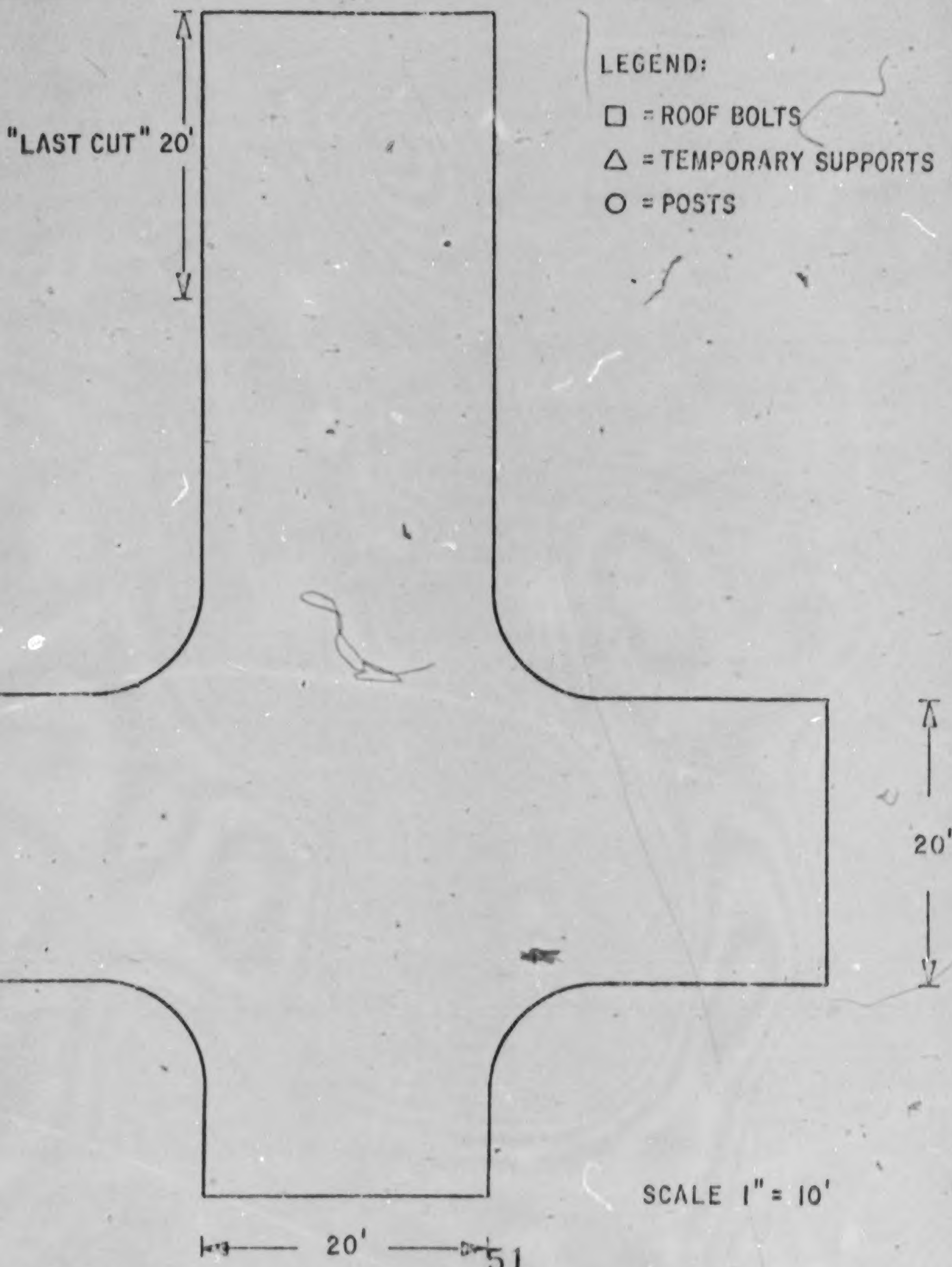
EQUIPMENT: Optional Table Top Mine Model

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Install an auxiliary fan at least 15 feet from the entry next to the inby rib.	SL 3 - 2 - 2
2) Attach sufficient tubing to the blowing end of the fan to insure the tubing is a maximum of 10 feet from the face.	
3) Suspend tubing to prevent interference with face equipment.	
4) Insure that the volume of air at the face exceeds the return air quantity to insure effectiveness.	NOTE: The fan must be located at least 15 feet from the entry to avoid mixing intake and exhaust air within the normal air flow.

METHOD OF EVALUATION:

The student will detail on transparency material placed over the scale entry and intersection schematic the placement of the fan and tubing with a grease pencil.


"LAST CUT" 20'
20'
20'

LEGEND:

□ = ROOF BOLTS

△ = TEMPORARY SUPPORTS

○ = POSTS

SCALE 1" = 10'

JOB: Construct a Dual Split Ventilation System Where Overcasts are Used. **JOB NUMBER:** J - 3B - 3

UNIT: III - Internal Mine Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale ventilation system schematic illustrating overcasts, transparency material and a grease pencil.

EQUIPMENT: Optional Table Top Mine Model

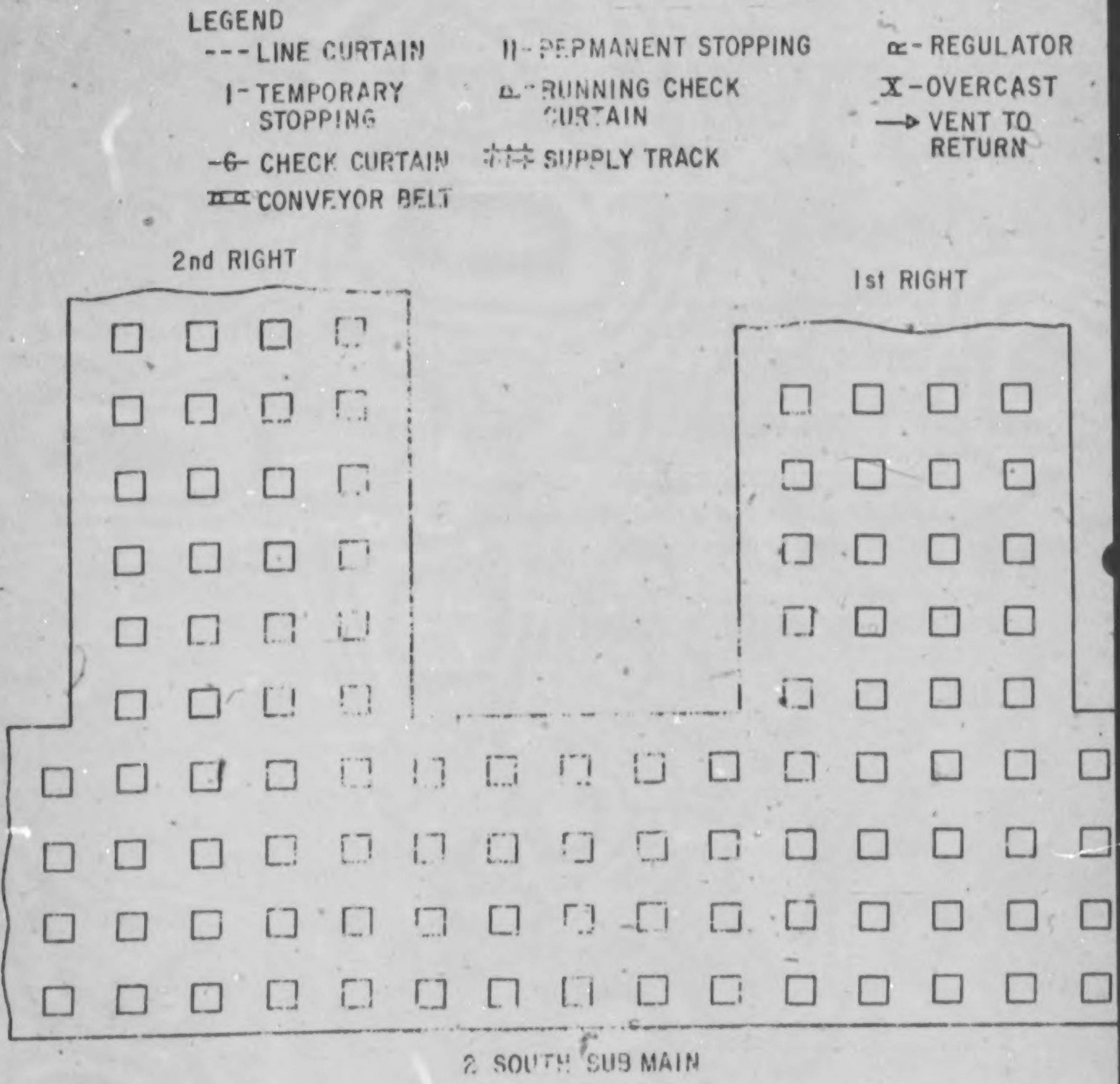
SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Place the intake air entries for 2 south sub main in entries No. 2 and No. 3. 2) Place overcasts in the first right andsecond right panels to provide for intake air. This provides return airways from the panel intake airways. 3) Place overcasts in the 2 south sub main to isolate the intake air from the conveyor runs out of the first right and second right panels.	

METHOD OF EVALUATION:

The student will detail on transparency material placed over the mine top the location of overcasts by making proper symbols with a grease pencil.

VENTILATION SYSTEM - ILLUSTRATING OVERCASTS


LEGEND
--- LINE CURTAIN
II - PERMANENT STOPPING
R - REGULATOR
I - TEMPORARY STOPPING
RUNNING CHECK CURTAIN
X - OVERCAST
→ VENT TO RETURN
-C- CHECK CURTAIN
SUPPLY TRACK
CONVEYOR BELT
2nd RIGHT
1st RIGHT
2 SOUTH SUB MAIN

JOB: Design a Track and Trolley Installation

JOB NUMBER: J - 3C - 1

UNIT: Unit: III - Internal Mine Construction

COURSE: Mine Equipment Maintenance

MATERIAL: Scale Mine Layout Schematic, transparency material and a grease pencil

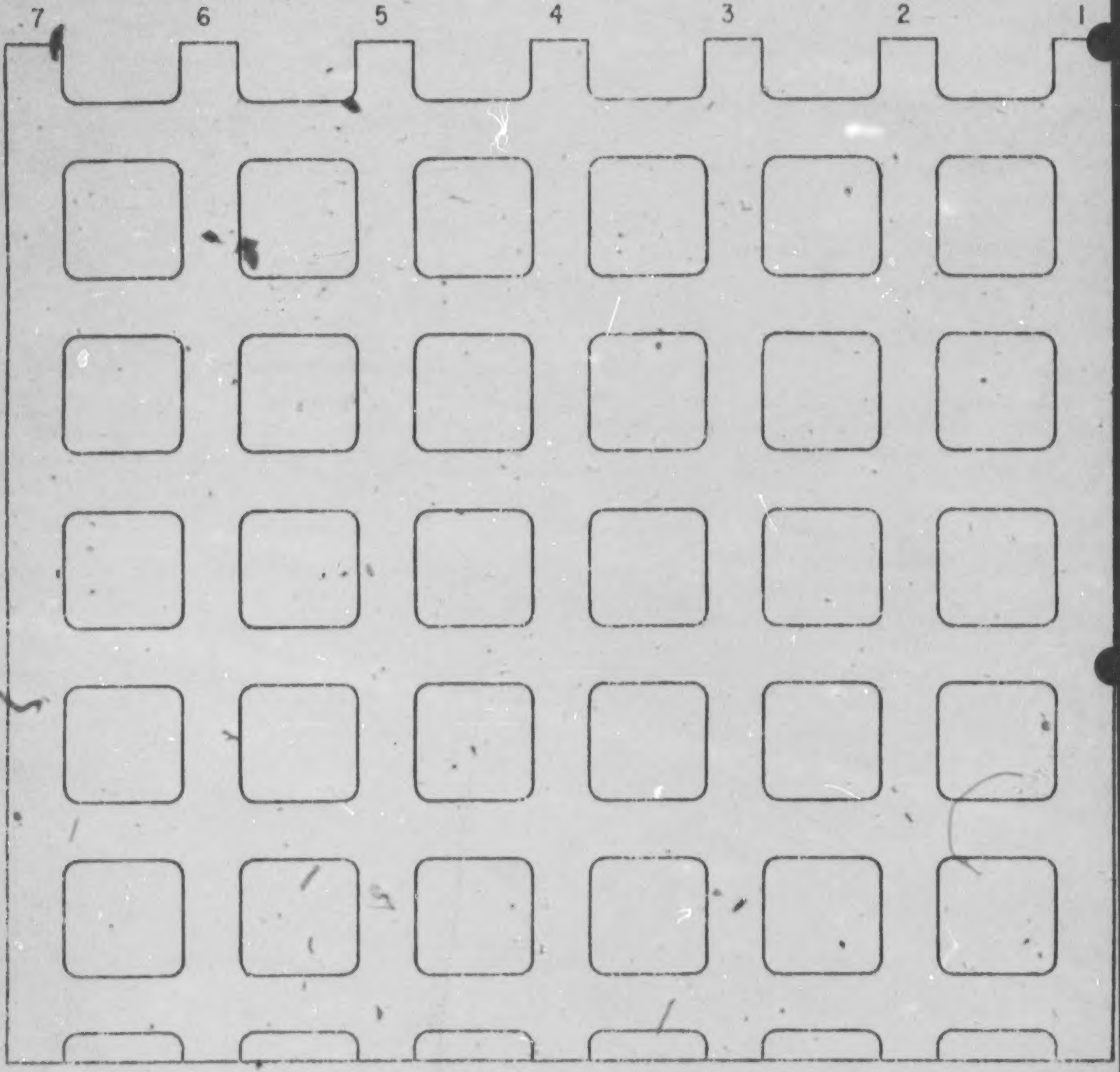
EQUIPMENT: Optional Table Top Mine Model

SAFETY PRECAUTIONS: When working on electrical equipment and accessories insure power if OFF at the source and all personnel (through a written notice) are aware to maintain it in the Off position while working on equipment.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Prepare road bed. 2. Install track. 3. Determine elevation of track on a curve. 4. Join and/or bend tracks. 5. Maintain tracks. 6. Install trolley wire fixtures. 7. Install trolley wires 8. Locate frogs for trolley wire. 9. Maintain trolley wire.	NOTE: A diagram of a scale mine layout is located on the back of this sheet.

METHOD OF EVALUATION: The student will detail on transparency material the design and location of a track and trolley installation. The transparency will be placed over the scale mine layout.

7 ENTRY CONTINUOUS MINING DEVELOPMENT PLAN



LEGEND

[M] CONT MINER
[R] ROOF BOLTER
[S] SHUTTLE CAR
[P] POWER CENTER
[F] FEEDER
[BT] BATTERY CHARGING STATION
x=x CONVEYOR BELT

A – S.C. CABLE ANCHOR
X – CABLE HANGER
SH – "SUPPLY HOLE" AREA
--- LINE CURTAIN
I – TEMPORARY CURTAIN
II – PERMANENT STOPPING
‡‡‡ – SUPPLY TRACK

o. – RUNNING CHECK CURTAIN
cc – REGULATOR
E – FIRE PROTECTION
→ – VENT TO RETURN
-C- – CHECK CURTAIN
-D- – DOOR

JOB: Design a Water Removal Plan **JOB NUMBER:** J - 3D - 1

UNIT: III - Internal Mine Construction

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Gather water in sumps on settling pools. 2. Place a gathering pump at the water location. Calculate lift requirement is any. 3. Install piping from gathering pump to main pump. 4. Place a main pump at a central location and determine required capacity for function. 5. Discharge water into a holding pond for possible acid treatment.	

METHOD OF EVALUATION: Instructor will provide student with a water problem in a mine. The example should include the volume and height the water must travel for removal. Instructor will evaluate plan based upon student accounting for all factors involved in calculation of needed equipment.

JOB: Prepare Face for Blasting

JOB NUMBER: J - 4 - 1

UNIT: Mining Procedures, Machines & Equipment

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Universal Cutting Machine & Face Drill

SAFETY PRECAUTIONS: Always work under a supported roof. Check the roof frequently and scale if necessary.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Undercut coal seam with an 8 - 10 foot universal cutter bar. 2. Sidecut coal seam along the rib. 3. Topcut coal to control a weak top. 4. Drill rib holes parallel to the centerline of the working place at least 12 inches from the side of the cut. 5. Continue drilling holes across the face at least 12 inches from the roof and bottom.	NOTE: Top cutting is necessary only to control a weak or tender top or because of a rolling floor, sulfur balls, etc. Drill holes should not be drilled closer than six inches to the back of the undercut. Normally four to 10 holes are drilled in a face.

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Prepare Blasting Agents **JOB NUMBER:** J - 4 - 2

UNIT: Mining Procedure, Machines & Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Electric Blasting Cap, Permissible Explosive Cartridges.

EQUIPMENT: Dynamite Punch

SAFETY PRECAUTIONS: Do not remove shunts from leg wires until the blaster is ready to connect the shot or shots to the shooting cable.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Use a dynamite punch to insert electric blasting cap.	SL 3 - 1 - 1
2. Secure wires to primer cartridge.	SL 3 - 1 - 2
3. Charge drill hole.	SL 3 - 1 - 3
4. Tamp drill hole.	SL 3 - 1 - 4
5. Fabricate series of blasting agents.	SL 3 - 1 - 5
6. Test series of blasting agents and circuits.	SL 3 - 1 - 6

METHOD OF EVALUATION: Instructor evaluation and/or testing.

JOB: Firing Blasting Agents **JOB NUMBER:** J - 4 - 3

UNIT: Mining Procedures, Machines & Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Blasting agents properly tamped and wired in blast holes to blasting cable.

EQUIPMENT: Blasting machine

SAFETY PRECAUTIONS: Insure shunts are not removed from leg wires prior to blasting.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Remove all explosives not connected to a container out of the firing area at least 50 feet. Also, insure explosives are at least 15 feet from pipelines, powerlines, rails or conveyors. 2. Remove all persons from adjoining areas. 3. Check for the presence of methane in the area of the blast. 4. Unwind blasting cable to a minimum of 100 feet from the face. Insure cable is long enough to permit shot fires to be around a corner from the face. 5. Shout "fire" as a warning three times. 6. Remove shunts from shooting cable and connect to blasting machine. 7. Detonate blast. 8. Disconnect blasting cable from power source.	

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Cutting Machine Preventive Maintenance

JOB NUMBER: J - 4 - 4

UNIT: IV Mining Procedures, Machinery and Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Lubricants, Cutting Bits

EQUIPMENT: Grease Gun, Grease Pump and Allen Wrench

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the machine's trailing cable and check for breaks in the insulation or poor splices. Insure power is Off when this check is made.	SL 4 - 2 - 1
2. Check headlights for proper operation.	
3. Check the methane monitor for proper operation.	
4. Remove debris from operator's platform, cable reel area and from the top of the machine. This can be accomplished through a wash-down procedure.	
5. Lubricate the machine according to the lubrication chart, specifications and time intervals.	
6. Replace worn or damaged cutter chain bits. - set bit control lever on center to prevent starting or turn machine off at the pump motor. - loosen set screw with wrench and remove bit. - replace bit and tighten set screw.	
7. Listen and feel for unusual sounds or operation during a production shift.	
8. Observe hydraulic and electrical hoses and wiring for breaks and abrasions.	

METHOD OF EVALUATION:

Instructor observation and/or testing.

JOB: Face Drill Preventive Maintenance

JOB NUMBER: J-4-5

UNIT: IV Mine Procedures, Machinery and Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Lubricants, Drill Auger

EQUIPMENT: Grease Gun

SAFETY PRECAUTIONS: Auger and allied parts may be hot. Always wear gloves. Also wear safety glasses when stricking auger pin with a hammer.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the machine's trailing cable and check for breaks in the insulation or poor splices. Insure power is off when this check is made. 2. Check headlights for proper operation. 3. Check the methane monitor for proper operation. 4. Remove debris from operator's platform, cable reel area, and from the top of the machine. This can be accomplished through a wash-down procedure. 5. Lubricate the machine according to the lubrication chart, specifications and time intervals. 6. Remove and replace drill auger. - turn machine off at pump motor to insure auger control valve does not begin to operate. - remove auger pin from motor end of steel by striking it with a hammer. - slide auger out through thrust bearing. - replace auger through the thrust bearing. - install pin through drill chuck and steel. 7. Listen and feel for unusual sounds or operation during a production shift. 8. Observe hydraulic and electrical hoses and wiring for breaks and abrasions.	SL 4-2-1

METHOD OF EVALUATION:

Instructor observation and/or testing.

JOB: Loader Preventive Maintenance

JOB NUMBER: J - 4 - 6

UNIT: IV Mining Procedures, Machinery and Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Lubricants

EQUIPMENT: Grease Gun, Grease Pump

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the machine's trailing cable and check for breaks in the insulation or poor splices. Insure power is off when this check is made. 2. Check headlights for proper operation. 3. Check the methane monitor for proper operation. 4. Remove debris from the operator's area and the top of the machine. This can be accomplished through a wash-down procedure. 5. Lubricate the machine according to the lubrication chart, specifications and time intervals. 6. Observe the two tension springs on the rear conveyor to insure the tail roller rotates properly and the springs are extending and contracting when the conveyor is pivoted left or right. 7. Remove any accumulation of material under the conveyor. 8. Check the traction chains for tightness. Excessive sag should be eliminated by shimming the track take-up. 9. Observe hydraulic and electrical hoses and wiring for breaks and abrasions. 10. Listen and feel for unusual sounds or operation during a production shift.	SL 4 - 2 - 1

METHOD OF EVALUATION:

JOB: **Shuttle Car Preventive Maintenance** JOB NUMBER: **J - 4 - 7**

UNIT: **IV Mining Procedures, Machinery and Equipment**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Lubricants**

EQUIPMENT: **Grease Gun, Grease Pump**

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the machine's trailing cable and check for breaks in the insulation or poor splices. Insure power is off when this check is made. 2. Check headlights for proper operation. 3. Remove debris from the operator's area and the top of the machine. This can be accomplished through a wash-down procedure. 4. Lubricate the machine according to the lubrication chart, specifications and time intervals. 5. Turn power on and check the high and low torque setting on the cable reel valve. Pull the cable to see if the valve shifts into low. Release cable and it should switch to the high torque position. 6. Check the conveyor flights and load chain to insure they are not bent. 7. Turn power on and check the steering valve for weak or borken springs. Releasing the wheel after turning right or left and releasing it, the wheel should return to neutral. The steering wheel should offer resistance when it is turned right or left. 8. Check the cam adjustment of the parking brake valve (lever lock valve) to see if it is properly releasing the service brakes. 9. Check the brake pedal and linkage to be sure the linkage is not fouled by debris. 10. Check the fire suppression activator's lever lock pins to insure they are operating properly.	SL 4-1-7 SL 4-1-11

METHOD OF EVALUATION: **Instructor observation and/or testing**

JOB: JOB NUMBER: J - 4 - 7 con't

UNIT:

COURSE:

MATERIAL:

EQUIPMENT:

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
11. Observe hydraulic hoses and electrical wiring for abrasions and breaks.	
12. Listen and feel for unusual sounds or operation during a production shift.	

METHOD OF EVALUATION:

JOB: **Roof Bolter Preventive Maintenance** JOB NUMBER: **J - 4 - 8**

UNIT: **IV Mining Procedures, Equipment and Machinery**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Lubricants**

EQUIPMENT: **Grease Gun, Grease Pump**

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the Machine's trailing cable and check for breaks in the insulation or poor splices. Insure power is off when this check is made.	**SL 4-1-7 SL 4-1-12**
2. Check headlights for proper operation.	
3. Remove debris from the operator's area and the top of the machine. This can be accomplished through a wash-down procedure.	
4. Lubricate the machine according to the lubrication diagram, specifications and time intervals.	
5. Prevent hydraulic damage to the machine by not setting relief valves higher than prescribed limits.	
6. Check the fire suppression activator's lever lock pins to insure they are operating properly.	
7. Observe hydraulic hoses and electrical wiring for abrasions and breaks.	
8. Report minor troubles before they became major.	

METHOD OF EVALUATION: **Instructor Observation and/or testing.**

JOB: Continuous Miner Preventive Maintenance **JOB NUMBER:** J - 4 - 9

UNIT: IV Mining Procedures, Machinery and Equipment

COURSE: Mine Equipment Maintenance

MATERIAL: Lubricants

EQUIPMENT: Grease Gun, Grease Pump

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Follow the machine's trailing cable and check for breaks in the insulation or poor splices. INsure power is off when this check is made. 2. Check headlights for proper operation. 3. Remove debris from the operator's area and the top of the machine. This can be accomplished through a wash-down procedure. 4. Lubricate the machine according to the lubrication chart, specifications and time intervals. 5. Check the traction cats for proper chain tension. Proper shimming of the track takeup should then be conducted. 6. Operate the conveyor chain and check for proper tension by swinging and raising the conveyor. 7. Check the methane monitor for proper operation. 8. Replace worn cutter head bits. 9. Remove and realign bit blocks if the bit or bit blocks are scuffed. 10. Check the fire suppression and water sprays for proper operation. 11. Observe hydraulic hoses and electrical wiring for abrasions. 12. Report minor troubles before they become major.	SL 4-1-7 SL 4-1-13 A

METHOD OF EVALUATION: Instructor Observation and/or testing

JOB: **Belt Conveyor Preventive Maintenance** JOB NUMBER: **J - 4 - 10**

UNIT: **IV Mining Procedures, Machinery and Equipment**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Lubricants**

EQUIPMENT: **Grease Gun, Grease Pump**

SAFETY PRECAUTIONS **Never operate belt until all personnel have been alerted that the belt will be operated.**

COMPETENCE -- PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check alighment of all frames, drives, take-ups, tai tail, etc., to insure a true turning belt, and the reduced possibility of run-off.	SL 4-1-7 SL 4-1-14
2. Provide adequate belt tension to prevent excessive belt sag.	
3. Lubricate idlers. Frozen or dragging idlers can cause excessive belt wear and increased horsepower requirements of the drive.	
4. Clean debris from drive pulleys to prevent belt slippage.	
5. Insure drive unit is rigidly anchored to insure it will not move under stress.	
6. Insure belt splices are square to reduce run-off.	
7. Check belts for side abrasions to preclude stretching.	
8. Report minor troubles before they become major.	

METHOD OF EVALUATION: **Instructor observation and/or testing.**

JOB: **Locomotive & Trolley Preventive Maintenance** JOB NUMBER: **J - 4 - 11**

UNIT: **IV Mining Procedures, Machinery and Equipment**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Lubricants**

EQUIPMENT: **Grease Gun, Grease Pump**

SAFETY PRECAUTIONS **When replacing trolley pole or working on the machine near a trolley wire insure no connection is made to the trolley wire. Securely block wheels of car or use safety chain to prevent car from moving.**

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check headlights for proper operation.	**SL 4-1-7**
2. Remove debris from top of machine and operator's area.	**SL 4-1-14**
3. Lubricate the machine according to the lubrication chart, specifications and time intervals.	
4. INspect brakes for proper operation. Adjust if necessary.	
5. Inspect tracks. Replace bolts, springs or bearings if excessive play and/or visible damage is evident.	
6. INspect axle cap bearings for proper operation. Replace bearing and seal if necessary. Properly lubricate bearings.	
7. Inspect DC motor brushes for wear and proper alighment. Replace and/or adjust if necessary.	
8. Inspect trolley pole for proper operation. If defective repair and/or replace pole and harp. Readjust new assembly.	
9. Report minor trouble before it becomes major.	

METHOD OF EVALUATION: **Instructor Observation and/or Testing**

JOB: **Dump and Scoop Preventive Maintenance** JOB NUMBER: **J - 4 - 12**

UNIT: **IV Mining Procedures, Machinery and Equipment**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Lubricants**

EQUIPMENT: **Grease Gun, Grease Pump**

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. **Follow the machine's trailing caibe and check for breaks in the insulation or poor splices. Insure power is off when this check is made.**	**SL 4-1-7** **SL 4-1-15**
2. **Check headlights for proper operation.**	
3. **Remove debris from the operator's platform and the top of the machine.**	
4. **Lubricate the machine according to the lubrication chart, specifications and time intervals.**	
5. **Check battery level with a hydrometer. Wear protective gloves and clothing while donducting this test and insure fluid does not come into contact with eyes or skin.**	
6. **Charge batteries by removing from car and connecting with a charger. Turn charger on and read ampere meter to insure proper charging.**	
7. **Check the brake pedal and linkage to be sure the linkage is not fouled by debris.**	
8. **Check the fire suppression activator's lever lock pins to insure they are operating properly.**	
9. **Observe hydraulic hoses and electrical wiring for abrasions and breaks.**	
10. **Report minor troubles before they become major.**	

METHOD OF EVALUATION: **Instructor observation and/or testing**

JOB: Assemble Parts According to Drawings **JOB NUMBER:** J-5A-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Drawings - Orthographic Projections, Sectional, Auxiliary and Detail Views

EQUIPMENT: Soft Mallets, Wrenches, Pullers, etc.

SAFETY PRECAUTIONS Use overhead cranes exceeding the weight of the assembly

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Gather drawings for specific assembly. Insure the correct engineering order or revision of drawing is used. 2. Procure auxiliary, section and structural drawings if necessary. 3. Name and describe each part or component in the assembly. 4. Describe or name the type of material indicated for each member or component of the assembly. 5. Proceed to assemble the components according to the drawing.	SC 5-1-1 SC 5-1-2 SC 5-1-3 SC 5-1-4 SC 5-1-5

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Disassemble Parts According to Drawings **JOB NUMBER:** J-5A-2

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Drawings - orthographic projections, sectional, auxiliary and detail views

EQUIPMENT: Soft mallets, wrenches, pullers, etc.

SAFETY PRECAUTIONS Use overhead cranes exceeding the weight of the assembly

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Gather drawings for specific assembly. Insure the correct engineering order or revision of drawing is used. 2. Procure auxiliary, section and structural drawings if necessary. 3. Name and describe each part or component in the assembly. 4. Describe or name the type of material indicated for each member or component of the assembly. 5. Disassemble components carefully to insure bearings, seals, and carriers can be reused if in good repair. Follow drawings to insure the above can be performed.	SC 5-1-1 SC 5-1-2 SC 5-1-3 SC 5-1-4 SC 5-1-5

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Construct a Box Without Welding **JOB NUMBER:** J-5B-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: 1/8-inch plate (5 pieces)

EQUIPMENT: Oxyacetylene Welding Equipment

SAFETY PRECAUTIONS Wear protective clothing and shields. Handle and operate oxygen and acetylene tanks with care

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Wire brush, sandblast or pickle metal to insure cleanliness. 2. Position metal with each piece correctly aligned with the other. 3. Adjust torch for a neutral flame. 4. Bring the torch to that part of the joint where the weld is to start. 5. Tack the two pieces together at their ends. 6. Tilt slightly the torch tip. This makes the flame point inward toward the flat or horizontal surface. 7. Inspect the weld for cleanliness, even bead, consistency of width and good appearance. 8. Continue welding in this manner until box is completed.	SC 5-2-1 SC 5-2-2 SC 5-2-3 SC 5-2-4

METHOD OF EVALUATION: Instructor observation and/or testing

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JOB: Construct a Box with Welding Rod JOB NUMBER: J-5B-2

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: 1/8-inch plate (5 pieces), welding rod

EQUIPMENT: Oxyacetylene Welding Equipment

SAFETY PRECAUTIONS Wear protective clothing and shields. Handle and operate oxygen and acetylene tanks with care.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Wire brush' sandblast or pickle metal to insure cleanliness. 2. Position metal with piece correctly aligned with the other. 3. Adjust torch for a neutral flame. 4. Tack the two pieces together at the ends. 5. Tilt slightly the torch tip. This makes the flame point inward toward the flat surface. 6. Add enough welding rod metal to crown the weld slightly. 7. Inspect the weld for an even bead, consistency of width, cleanliness and good general appearance. 8. Repeat necessary steps to complete box.	SC 5-2-1 SC 5-2-2 SC 5-2-3 SC 5-2-4 SC 5-2-5 SC 5-2-6

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Given a Template Cut a Piece of 1/8-inch Plate **JOB NUMBER:** J-5C-1

UNIT: Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: 1/8-inch plate' template or drawing

EQUIPMENT: Oxyacetylene Cutting Equipment

SAFETY PRECAUTIONS Wear protective clothing and shields. Handle and operate oxygen and acetylene tanks with care.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Adjust torch for a neutral flame.	SC 5-3-1
2. Use the smallest cutting tip available and practical.	SC 5-3-2
3. Point tip in the direction of cutting at a 15-20 degree angle.	
4. Keep the end of the preheating inner core just above the metal.	
5. Proceed to cut fast enought to provide a slight amount of drag at the line of cutting.	
6. Use a straight edge or similar accessory to cut straight edges.	
7. Use a circle cutting guide or similar tool for circles or curved areas.	
8. Inspect accuracy and quality of workmanship.	
9. Grind smooth edges.	

METHOD OF EVALUATION: Instructor evaluation and/or testing

JOB: Given a Detail Drawing DC Weld the Component **JOB NUMBER:** J-5D-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Metal plate, electrodes, drawings

EQUIPMENT: DC Arc Welding Equipment

SAFETY PRECAUTIONS Wear protective clothing and shields. Shield welding area from other persons. Avoid using arc welding equipment in wet or damp areas.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select material according to drawing.	SC 5-4-1
2. Clamp two pieces together and ground.	SC 5-4-2
3. Select electrode for the type of metal.	SC 5-4-3
4. Adjust arc welder for type and thickness of metal.	SC 5-4-4
5. Strike an arc.	SC 5-4-5
6. Manipulate electrode according to the type of weld to be employed.	SC 5-4-6
7. Insure the bead has good contour and penetration.	SC 5-4-7
8. Continue above steps until project is completed.	SC 5-4-8
9. Cool welds. Remove slag and inspect.	

METHOD OF EVALUATION: INstructor evaluation and/or testing.

JOB: Given a Detail Drawing AC Weld the Component **JOB NUMBER:** J-5E-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Metal plate, electrodes, drawings

EQUIPMENT: AC Arc Welding Equipment

SAFETY PRECAUTIONS Wear protective clothing and shields. Shield welding area from other persons. Avoid using equipment in wet or damp areas.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select material according to drawing. 2. Clamp two pieces together and ground. 3. Correctly shape the metal for the type of weld to be employed. 4. Wire brush, sandblast or pickle metal to insure cleanliness. 5. Start a weld. 6. Manipulate electrode according to type of weld to be used. 7. Stop weld and fill crater. 8. Repeat required steps to complete exercise. 9. Inspect job.	SC 5-5-1 SC 5-5-2 SC 5-5-3 SC 5-5-4

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: Calculate the Efficiency of a Mechanical Assembly **JOB NUMBER:** J-5F-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Drawing of a reducer

EQUIPMENT:

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Calculate the efficiency of a gear reduction system if there are 8 gear reductions. 2. Multiply first reduction by the common constant of .01 or one per cent loss of efficiency for each reduction times 100. This totals 1 or 99 per cent efficient. 3. Square 99 by the total number of reductions in the gear train. Thus, 99 to the 8th power is approximately 16 or a total efficiency of 83 per cent.	SC 5-6-1 SC 5-6-2 SC 5-6-3 SC 5-6-4

METHOD OF EVALUATION: Instructor observation and/or testing

JOB: Rebuild the Gathering Head Reducer

JOB NUMBER: J-5G-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Gathering head reducer components

EQUIPMENT: An array of mechanical tools

SAFETY PRECAUTIONS

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Insert bearing cup in the two blind bores. Note knock-out holes in case to remove these cups. 2. Insert pinion shaft thru the hole in the case and spline to gear. 3. Insert gear thru open top of case and hold in position. 4. Assemble bearing cones on gear and pinion. 5. Install six flat socket head mounting screws. 6. Install bearing cup over the cone on pinion. Install cap shimmed to proper bearing adjustment. 7. Mount spacer on idler shaft to gear inside housing. 8. Spline idler shaft to gear inside housing. 9. Mount bearing cone onto idler shaft. 10. Mount bearing cup and cap properly shimmed and adjusted to the housing. 11. Assemble clutch unit.	SC 5-7-1 SC 5-7-2 SC 5-10-1

METHOD OF EVALUATION: Instructor observation and/or testing

JOB: Assemble a Conveyor Chain in a Loading Machine **JOB NUMBER:** J-5H-1

UNIT: V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

MATERIAL: Conveyor chain and

EQUIPMENT: Conveyor chain assembly tool and various tools

SAFETY PRECAUTIONS Be careful to avoid overhead hazards when using a crane

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Relieve tension on conveyor chain springs. 2. Position chain at rear of conveyor 3. Feed chain toward front of machine. 4. Set first roller link against foot shaft sprocket. 5. Feed a stiff cable band under tail roller and thru return deck to foot shaft. 6. Attach cable to first linke and pull chain thru return deck and up onto tail roller. 7. Wedge chain at front of gathering head frame to prevent movement. 8. Swing conveyor 45 degrees to one side. 9. Pull rear section of chain toward front and lock with a connecting link. 10. Adjust conveyor chain tension.	SC 5-8-2 SC 5-10-3

METHOD OF EVALUATION: Instructor observation and/or testing.

JOB: **Remove and Replace a Rear Conveyor on a Loading Machine** JOB NUMBER: **J-51-1**

UNIT: **V Mine Mechanical Maintenance**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Rear Conveyor assembly**

EQUIPMENT: **Various standard mechanical tools and accessories**

SAFETY PRECAUTIONS **Support conveyor when installed. Do not rely on hydraulic support.**

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Block up the discharge section in its straight position.	**SC 5-7-4**
2. Disconnect conveyor lift jacks and hoses.	**SC 5-8-2**
3. Disconnect swing jacks and hoses.	**SC 5-10-3**
4. Remove upper and lower pivot pins and retainer rings.	
5. Repeat in reverse the preceding procedures for assembly.	
6. Shim bearing surface and adjust.	

METHOD OF EVALUATION: **Instructor observation and/or testing.**

JOB: Demonstrate Pressure Due to Weight

JOB NUMBER: J-6A-1

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Containers (different shapes and ports for gages) and water

EQUIPMENT: Pressure gages

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Fill containers with water 2. Check pressures at different heights 3. Calculate pressures and check with gages 4. Empty containers halfway and repeat above.	SC-6A-4 SC-6A-1

METHOD OF EVALUATION: Gage readings corresponding to calculated pressures

JOB: Demonstrate Pressure in Enclosed Containers **JOB NUMBER:** J-6A-2

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Containers (cylindrical), hose to connect cylinders, weights, water, seals for different containers

EQUIPMENT: Pressure gages

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect hoses to containers and connect gages. 2. Fill with water. 3. Put weights on top of fluid (seals installed prior to placing weights). 4. Check pressures. 5. Calculate pressures. 6. Change weights and repeat.	SC-6A-1 SC 6A-3

METHOD OF EVALUATION: Calculations and recorded data to agree.

JOB: Demonstrate Power Transfer by Cylinders **JOB NUMBER:** J-6A-3

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, cylinders, hoses, hydraulic fluid (or water), weights

EQUIPMENT: Pressure gages, flow meters, weight scales, stop watch, distance scales

SAFETY PRECAUTIONS: INsure all hoses are connected tightly.

COMPETENCE -- PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect pump and cylinders. Put weights on cylinders. 2. Operate pump. 3. Record times and distances ongages. 4. Calculate power requirements. 5. Repeat using different weights.	SC 6A-1 SC 6A-2 SC 6A-3 SC 6A-4 SC 6A-5

METHOD OF EVALUATION: Calculated fluid power to agree with actual power transfer.

JOB: Demonstrate Power Transfer by Motor **JOB NUMBER:** J 6A-4

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, motor hoses, hydraulic fluid, weights, pulley system

EQUIPMENT: Pressure gages, flow meter, weight scales, stop watch, distance scale

SAFETY PRECAUTIONS: Insure all hoses are connected tightly

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect pump and motor. Connect weights to motor using pulley system. 2. Operate pump. 3. Record times, distances, and all gages. 4. Calculate power requirements 5. Repeat using different weights.	SC 6A-1 SC 6A-2 SC 6A-3 SC 6A-4 SC 6A-5

METHOD OF EVALUATION: Calculated fluid power to agree with actual power transfer.

JOB: Demonstrate Power Losses **JOB NUMBER:** J 6A-5

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, hoses, hydraulic fittings, orifices

EQUIPMENT: Pressure gages, flow meters

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect pump to hosing. 2. Record pressure and flow. 3. Add hydraulic fittings & record. 4. Add orifices and record. 5. Repeat using different hosing combinations.	SC 6A-1 SC 6A-2

METHOD OF EVALUATION: Pressure losses to increase as more pieces are added.

JOB: Demonstrate Pump and Flow Characteristics **JOB NUMBER:** J 6B-1

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pumps, hoses, shut-off valve

EQUIPMENT: Pressure gages and flow meter

SAFETY PRECAUTIONS: Make certain pressure does not exceed pump capacity

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect pump to metering valve. 2. Increase pressure. 3. Record pressure and flow. 4. Repeat with each of the four types of pumps.	SC 6A-1 SC 6A-2

METHOD OF EVALUATION: Pressure and flow to agree with published figures.

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JOB: Demonstrate Accummulator, Flow and Pressure **JOB NUMBER:** J 6B-2

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Accummulator, shut-off (metering type) valve, hosing, dry nitrogen, hand pump

EQUIPMENT: Pressure gage, flow meter

SAFETY PRECAUTIONS: Do not over pressurize accummulator

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect accumulator to shut-off valve and to hand pump.	SC 6A-1 SC 6A-2
2. Pressurize accumulator with nitrogen.	
3. Pressurize accumulator with hand pump.	
4. Record flow and pressure.	
5. Repeat after depressurizing nitrogen charge.	

METHOD OF EVALUATION: Check to see that pressure and flow meets published specs. and gas laws.

JOB: Set up Basic Circuit - Pump and Cylinder **JOB NUMBER:** J-6B-3

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, cylinder, reservoir, & hoses

EQUIPMENT: Pressure gage, flow meter, stop watch & weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design basic circuit 2. Connect pump to cylinder using design. 3. Demonstrate how it works. 4. Record pressures and flows. 5. Check times and forces.	

METHOD OF EVALUATION: Design to be correct. Pump and cylinder speed and force to agree with basic laws.

JOB: Set up Basic Circuit - Pump and Motor **JOB NUMBER:** J 6B-4

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, MOtor, Reservoir & Hoses

EQUIPMENT: Pressure gage, flow meter, stop watch & weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design basic circuit. 2. Connect pump to motor using design. 3. Demonstrate how it works. 4. Record pressures and flows. 5. Check times and forces.	

METHOD OF EVALUATION: Design to be correct. Pump and cylinder speed and force to agree with basic laws.

JOB: Set up Basic Circuit Using Relief Valve **JOB NUMBER:** J 6B-5

UNIT: VI Hydraulics

COURSE: Mine EQuipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoes & Relief valve

EQUIPMENT: Pressure gage, flow meter, stop watch & weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Set up Basic Circuit Using a Series Type Open Center Directional Control Valve **JOB NUMBER:** J 6B-6

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, MOtor, Reservoir, Hoses, Directional Control Valve & Relief Valve

EQUIPMENT: Pressure Gage, Flow meter, Stop watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Setup Basic Circuit Using Parallel Type Open Center Directional Control Valve

JOB NUMBER: J 63-7

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor' Reservoir, Hoses, Relief Valve & Directional Control Valve

EQUIPMENT: Pressure Gage, Flow meter, Stop Watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly

JOB: **Setup Basic Circuit with Shut Off Valve** JOB NUMBER: **J 6B-8**

UNIT: **VI Hydraulics**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Pump, Motor, Reservoir, Hoses, Relief Valve & Shut Off Valve**

EQUIPMENT: **Pressure Gage, Flow meter, Stop Watch & Weights**

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit.	
2. Setup circuit as designed.	
3. Check flow and pressures.	
4. Repeat using other relief valve.	

METHOD OF EVALUATION: **Circuit to operate correctly**

JOB: Setup Basic Circuit with Check Valve JOB NUMBER: J 6B-9

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoses, Relief Valve & Check Valves

EQUIPMENT: Pressure Gage, Flow meter, Stop Watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly

JOB: Setup Basic Circuit Using Sequence Type Control Valve

JOB NUMBER: J 6B-10

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoses, Relief Valve & Sequence Type Directional Control Valve

EQUIPMENT: Pressure Gage, Flow Meter, Stop Watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly;

JOB: Setup Basic Circuit Using Counterbalance Type Valve JOB NUMBER: J 6B-11

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoses, Relief Valve & Counterbalance Type Valve

EQUIPMENT: Pressure gage, Flow meter, Stop watch & Weights.

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit.	
2. Setup circuit as designed.	
3. Check flow and pressures.	
4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Setup Basic Circuit Using Pressure Reducing Valve JOB NUMBER: J 6B-12

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoses, Relief Valve & Pressure Reducing Valve

EQUIPMENT: Pressure, Gage, Flow meter, Stop watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Design Basic Circuit Using Flow Control Valves JOB NUMBER: J 6B-13

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir' Hoses, Relief Valve & Flow Control Valves

EQUIPMENT: Pressure gage, Flow meter, Stop watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1 Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Setup Basic Circuit Using Unloading Valve and Relief Valve JOB NUMBER: J 6B-14

UNIT: V1 Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Pump, Motor, Reservoir, Hoses, Relief Valve & Unloading Valve

EQUIPMENT: Pressure gage, Flow meter, Stop watch & Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit. 2. Setup circuit as designed. 3. Check flow and pressures. 4. Repeat using other relief valve.	

METHOD OF EVALUATION: Circuit to operate correctly.

JOB: Demonstrate Filter Types JOB NUMBER: J 6C-1

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Filters, Pump, Motor, Reservoir, Hoses & Relief Valves

EQUIPMENT: Pressure, gage, Flow meter, Stop watch & weights

SAFETY PRECAUTIONS:

COMPETENCE -- PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design circuit using following filters: a. Suction filter b. Pressure filter c. Return filter 2. Setup circuit. 3. Add dirt to system and observe.	

METHOD OF EVALUATION: See that circuit is correct and dirt is filtered out of system.

JOB: Demonstrate Coolers

JOB NUMBER: J 6C-2

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Coolers, Filters, Pump, Motor, Reservoir, Hoses & Relief Valves

EQUIPMENT: Thermometer, Pressure gage, Flow meter, Weights

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Design basic circuit. 2. Operate circuit to heat up. 3. Start cooler. 4. Record pressure, flow and temperatures.	

METHOD OF EVALUATION: Check to see that temperature drops correctly.

JOB: Demonstrate Hydrostatic Transmissions JOB NUMBER: J 6C-3

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Hydrostatic Transmissions (open and closed circuit, constant and variable torque and and horsepower types)

EQUIPMENT: Pressure gage, flow meter

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Setup transmissions. 2. Record pressures and flows. 3. Repat for all types.	

METHOD OF EVALUATION: Check all recordings to see if correct.

JOB: **Setup Circuit with NPT Fittings** JOB NUMBER: **J 6C-4**

UNIT: **VI Hydraulics**

COURSE: **Mine Equipment Maintenance**

MATERIAL: **Hydraulic fittings (NPT), Pump, Valve, Cylinder, Hoses**

EQUIPMENT: **Pressure gage and flow meter**

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect material using fewest fittings and hos. 2. Check pressure and flow.	

METHOD OF EVALUATION: **Check pressure and flow to see if it meets lowest pressure reading. Check for leakage.**

JOB: Setup Circuit with JIC Fittings JOB NUMBER: J 6C-5

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Hydraulic fittings (JIC), pump, valve, cylinder & hoses

EQUIPMENT: Pressure gage and flow meter

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect material using fewest fittings and hose. 2. Check pressure and flow.	

METHOD OF EVALUATION: Check pressure and flow to insure it meets lowest pressure reading. Check for leakage.

JOB: Setup Circuit with Staple Type Fittings JOB NUMBER: J 6C-6

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Hydraulic fittings (staple type), Pump, valve, cylinder, & hoses

EQUIPMENT: Pressure gage, flow meter

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect material using fewest fittings and hose. 2. Check pressure and flow.	

METHOD OF EVALUATION: Check pressure and flow to insure it meets lowest pressure reading. Check for leakage.

JOB: Demonstrate Fluid Types JOB NUMBER: J 6C-7

UNIT: VI Hydraulics

COURSE: Mine Equipment Maintenance

MATERIAL: Hydraulic Fluids (see below)

EQUIPMENT: Wear tester, Saybolt viscosity tester, Bunsen burner

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Compare Lubricity. 2. Compare fire resistance 3. Compare viscosity. 4. Compare appearance.	Fluid types: a. Petroleum based fluid b. Phosphate ester c. Invert emulsion d. Straight emulsion NOTE; Instructor to do tests for lubricity and viscosity.

METHOD OF EVALUATION: Compare data to agree with published data.

JOB: Build Wet Cell Battery **JOB NUMBER:** J - 7A - 1

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: Glass Container
Salt (or Sulfuric Acid)
Water
Zinc Plate
Copper Plate

EQUIPMENT: Voltmeter

SAFETY PRECAUTIONS: Care in handling glass container
Wear safety glasses when pouring liquids. Extreme caution if sulfuric acid is used to avoid burns to skin

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Mixsolution of salt and water (sulfuric acid may be used as the electrolyte).	SC 7 - 1 - 1 SC 7 - 1 - 2
2) Pour into glass container	IL 7 - 1 - 1
3) Suspend zinc and copper plates in the solution	IL 7 - 1 - 5
4) Measure voltage with voltmeter	
5) Diagram the chemical reaction	

METHOD OF EVALUATION: Working battery
Correct chemical reaction

JOB: Disassemble Dry Cell **JOB NUMBER:** J - 7A - 2

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: Dry Cell

EQUIPMENT: Hack Saw

SAFETY PRECAUTIONS: Use care in cutting cell
Wear safety glasses

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Cut dry cell in half with hack saw 2) Identify components: Positive Terminal Negative Terminal Carbon Rod Core Electrolyte Zinc Container	IL 7 - 1 - 5

METHOD OF EVALUATION:

Correct identification of components

JOB: Build Electromagnet **JOB NUMBER:** J - 7A - 3

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: Dry Cell
Wire
Metal Objects (Tacks, Paper Clips)
Nail or Metal Bar

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Wrap 5 turns of wire around metal bar	SC 7 - 1 - 3
2) Connect ends of wire to terminals of dry cell	SC 7 - 1 - 4
3) Pick up metal objects. Count objects magnet will hold	
4) Disconnect battery. Note that magnetic field collapses	
5) Increase coil to 10 turns. Count objects magnet will hold	

METHOD OF EVALUATION:

Build working magnet

JOB: Demonstrate Alternating and Direct Current

JOB NUMBER: J - 7A - 4

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Oscilliscope, A.C. Power Source, Battery, Diode Bridge

SAFETY PRECAUTIONS: Use caution when making electrical connections

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Connect oscilliscope leads to A.C. power supply Draw pattern on paper	IL 7 - 1 - 6
2) Connect single diode to A.C. supply. Connect oscilliscope to diode. Draw pattern	
3) Connect oscilliscope to output of diode bridge. Draw pattern.	
4) Connect oscilliscope to battery. Draw pattern.	
5) Compare patterns from four oscilliscope tracings	

METHOD OF EVALUATION:

Explanation of traces
Proper connection of terminals
Safe operation

JOB: Calculate Resistance, Voltage, Current, Power **JOB NUMBER:** J - 7A - 5

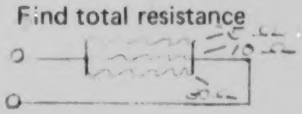
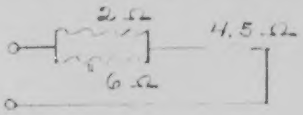
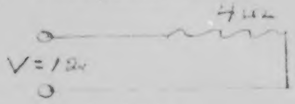
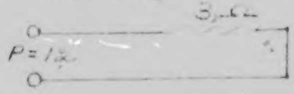
UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: Paper
Pencil

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Find total resistance  R_T = 3 ohms	IL 7 - 1 - 7
2) Find total resistance  R_T = 6 ohms	
3) Find power in watts  P = 36 watts	"A Training Program for D.C. Mining Machinery" Joy Mfg. Co.
4) Find voltage  I = 2 amps E = 6 volts	

METHOD OF EVALUATION:

Correct answers
Proper calculations

JOB: Build Basic D.C. Circuit **JOB NUMBER:** J - 7A - 6

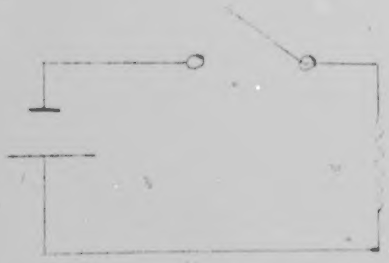
UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: Dry Cell, Wire, Switch, Light Bulb

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Connect wire from battery terminal to switch, switch to light bulb, light bulb to other terminal 2) Close switch. Light should light 3) Open switch. Light should go out 4) Identify: Source Load Control Conductor	IL 7 - 1 - 8 

METHOD OF EVALUATION:

Light lights
Proper identification of elements

JOB: Build a DC Motor **JOB NUMBER:** J - 7A - 7

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

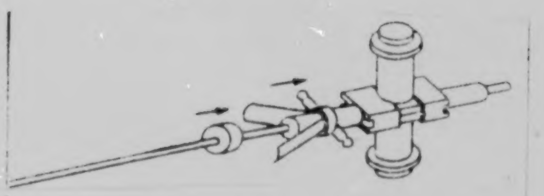
MATERIAL:
Battery
Battery Holder
Base
Brackets
Two Magnets
Magnet Holders
Armature Shaft
Split Contacts
Metal Brushes
Varnished Copper Wire

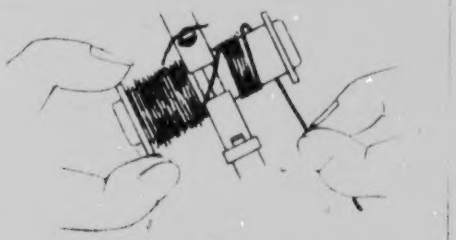
EQUIPMENT:

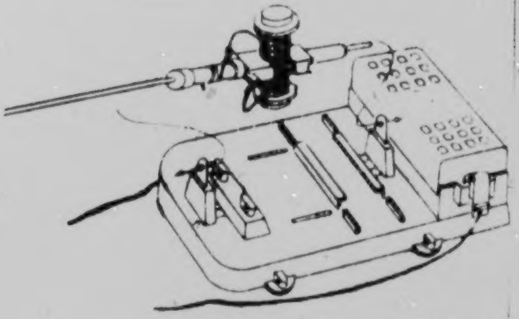
SAFETY PRECAUTIONS:

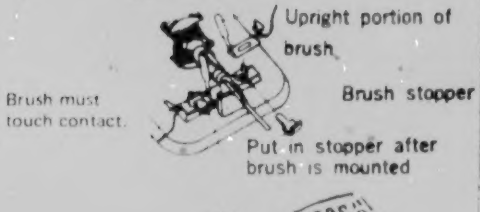
COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Assemble armature shaft with core for armature coil and split contacts. 2. Wind 55 turns of copper wire on one bobbin, cross over and wind 55 turns on other bobbin. Bare leads and connect to split contacts. 3. Mount armature on brackets. 4. Mount magnets in magnet holders. 5. Assemble battery holder 6. Connect wires from battery terminals to metal brushes. 7. Mount brushes to contact with split contacts.	

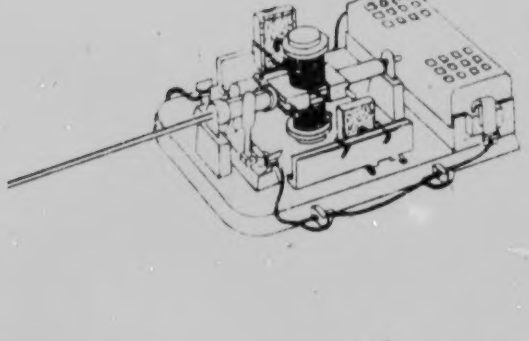
METHOD OF EVALUATION: Proper construction of motor.
Motor runs.








Upright portion of brush
Brush stopper
Brush must touch contact.
Put in stopper after brush is mounted



JOB: Build D.C. Generator **JOB NUMBER:** J - 7A - 8

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

MATERIAL: A.C. Motor, Rubber Bands, D.C. Motor Kit

EQUIPMENT: Brackets and Base
Voltmeter

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Build base to align shaft of A.C. motor parallel with D.C. motor built in previous job. Connect shafts with rubber bands 2) Turn on A.C. motor, driving D.C. motor (generator) 3) Connect voltmeter to leads from D.C. motor (generator) and measure voltage generated.	IL 7 - 1 - 9

METHOD OF EVALUATION:

Construction of assembly
Measurement of voltage

JOB: Build Series and Parallel Circuits **JOB NUMBER:** J - 7A - 9

UNIT: VII A Elements of Electricity

COURSE: Mine Equipment Maintenance

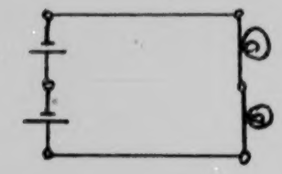
MATERIAL:
3 Dry Cells
3 Light Bulbs
Wire
Switch

EQUIPMENT:
Voltmeter
Ammeter

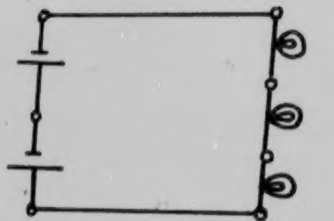
SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES

1) Wire circuit shown



2) Measure voltages
   Terminals 1 & 5 =
   Terminals 2 & 4 =
   Terminals 2 & 3 =
   Terminals 3 & 4 =
   Terminals 1 & 6 =
3) Wire circuit shown



METHOD OF EVALUATION:

JOB: Build Series and Parallel Circuits

JOB NUMBER: J - 7A - 9
Page 2

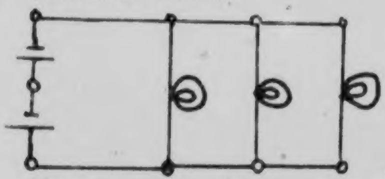
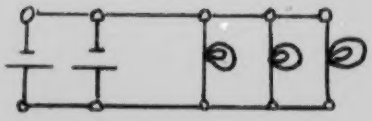
UNIT:

COURSE:

MATERIAL:

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
4) Measure voltages between Terminals 2 & 5 = Terminals 2 & 4 = Terminals 2 & 3 = 5) Wire circuit shown  Measure voltages between Terminals 2 & 7 = Terminals 3 & 6 = Terminals 4 & 5 = Terminals 2 & 3 = Terminals 2 & 4 = 6) 	

METHOD OF EVALUATION:

JOB: Build Series and Parallel Circuits

JOB NUMBER: J - 7A - 9
Page 3

UNIT:

COURSE:

MATERIAL:

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
Measure voltages between Terminals 1 & 10 = Terminals 2 & 9 = Terminals 3 & 8 = Terminals 4 & 7 = Terminals 5 & 6 = 7) Compare voltages in series and parallel circuits	

METHOD OF EVALUATION:

JOB: Design and Build a Light Circuit **JOB NUMBER:** J - 7B - 1

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

MATERIAL:
Basic A.C. Training Panel
Patch Cords
Student Work Sheets

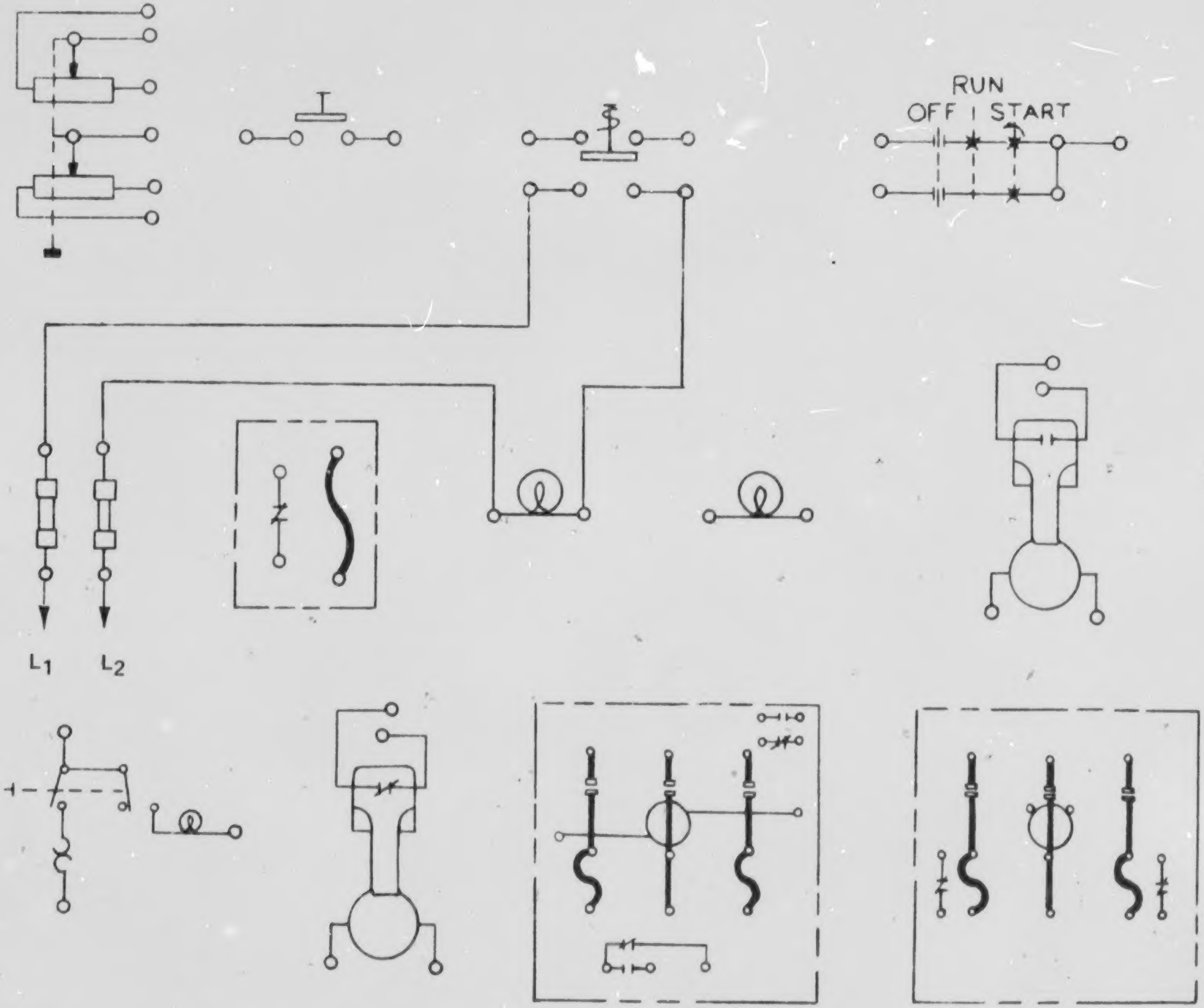
EQUIPMENT:

SAFETY PRECAUTIONS:
Always disconnect power when wiring panel
Visually check circuit before applying power
Keep hands away from energized panel

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) On student work sheets, draw line indicating conductor from L_1, connecting fuses, pushbutton switch and light bulb.	SC 7 - 2 - 1 SC 7 - 2 - 2
2) Disconnect power from training panel.	
3) Wire the light circuit on the training panel.	
4) Visually check circuit for short or other faults.	
5) Energize panel. Demonstrate light circuit.	

METHOD OF EVALUATION:
Circuit drawing
Panel wiring
Working circuit

DRAWING J-7B-1


RUN
OFF
START
L1
L2

JOB: Design and Build Motor Circuit **JOB NUMBER:** J - 7B - 2

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

MATERIAL: Basic A.C. Training Panel
Patch Cords
Student Work Sheets

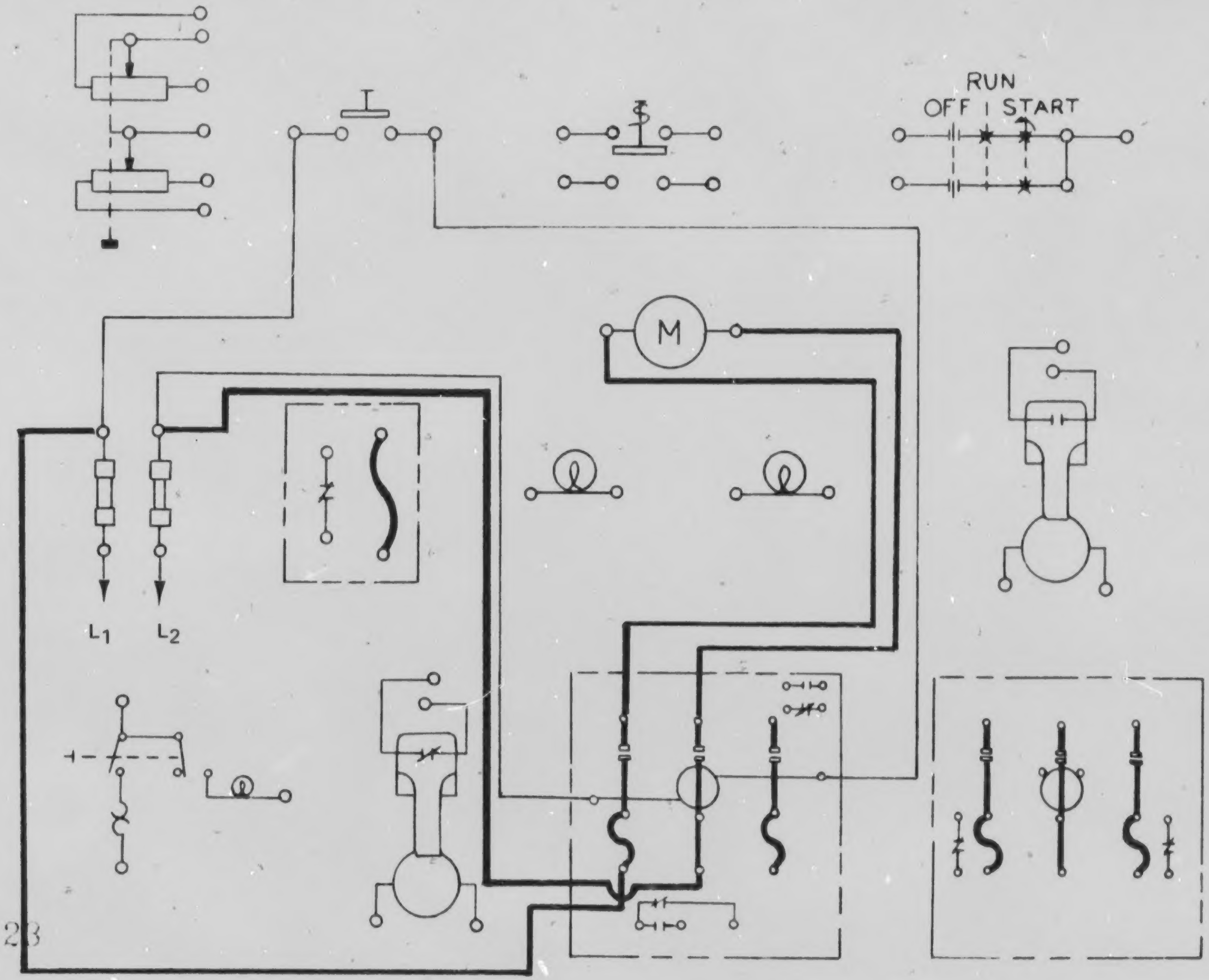
EQUIPMENT:

SAFETY PRECAUTIONS: Disconnect power when wiring panel.
Visually check circuit before applying power
Keep hands away from energized panel

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) On student work sheet, draw control circuit from L_1 fuse to on-off switch, through linestarter coil, to L_2 fuse. Draw power circuit from L_1 to linestarter contact, to motor lead, back through center contact to L_2.	SC 7 - 2 - 3 SC 7 - 2 - 4
2) Disconnect power from panel.	
3) Wire circuit from drawing	
4) Visually check circuit	
5) Energize panel. Demonstrate circuit.	NOTE: Circuit operation. Turn switch to "On". Energizes linestarter coil. Contacts close, motor runs

METHOD OF EVALUATION:

Circuit drawing
Panel wiring
Circuit operation


RUN
OFF
START
M
L1
L2

JOB: Design and Build Motor Holding Circuit

JOB NUMBER: J - 7B - 3

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

MATERIAL: Basic A.C. Training Panel
Patch Cords
Student Work Sheets

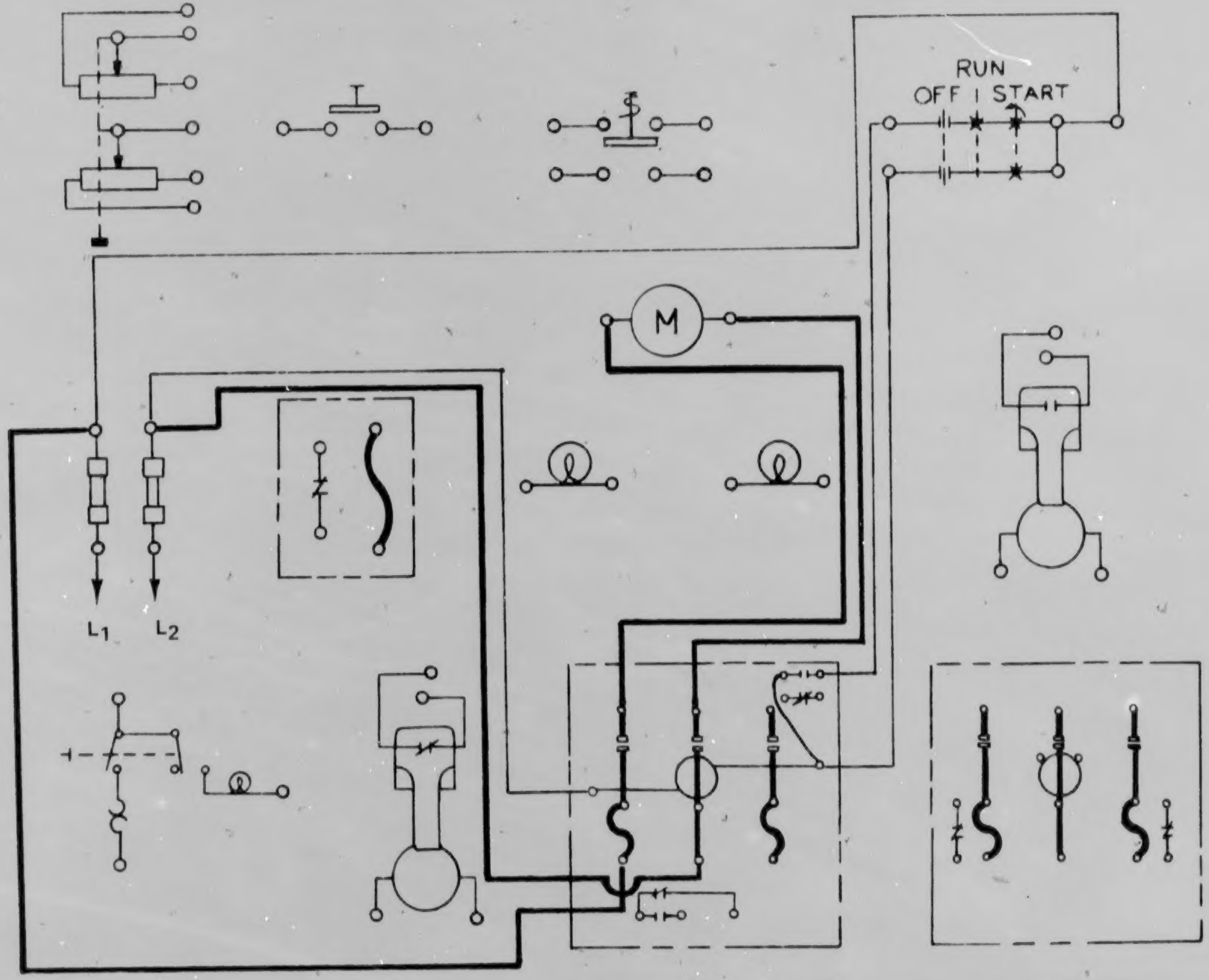
EQUIPMENT:

SAFETY PRECAUTIONS:
Disconnect power when wiring panel.
Visually check circuit before applying power
Keep hands away from energized panel.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) On student work sheets, draw control circuit from L_1 fuse to off-run-start switch, from start terminal to linestarter coil, from run position through normally open auxiliary contact to coil. Draw power circuit from L_1 fuse through left linestarter contacts to motor lead, back through center contact tips to L_2.	SC 7 - 2 - 5
2) Disconnect power	
3) Wire circuit	NOTE: Circuit operation. Turn switch to "Start" position. Linestarter coil is energized. Motor starts. Auxiliary N.O. contacts close. Release switch to "Run". Closed "N.O." contacts hold circuit. Motor continues to run.
4) Visually check circuit	
5) Energize panel. Demonstrate circuit	

METHOD OF EVALUATION:
Circuit drawing
Panel wiring
Circuit operation

DRAWING J - 7B - 3


RUN
OFF
START
M
L_1
L_2

JOB: Design Holding Circuit with Control Switch **JOB NUMBER:** J - 7B - 4

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

MATERIAL:
Basic A.C. Panel
Patch Cords
Student Work Sheets

EQUIPMENT:

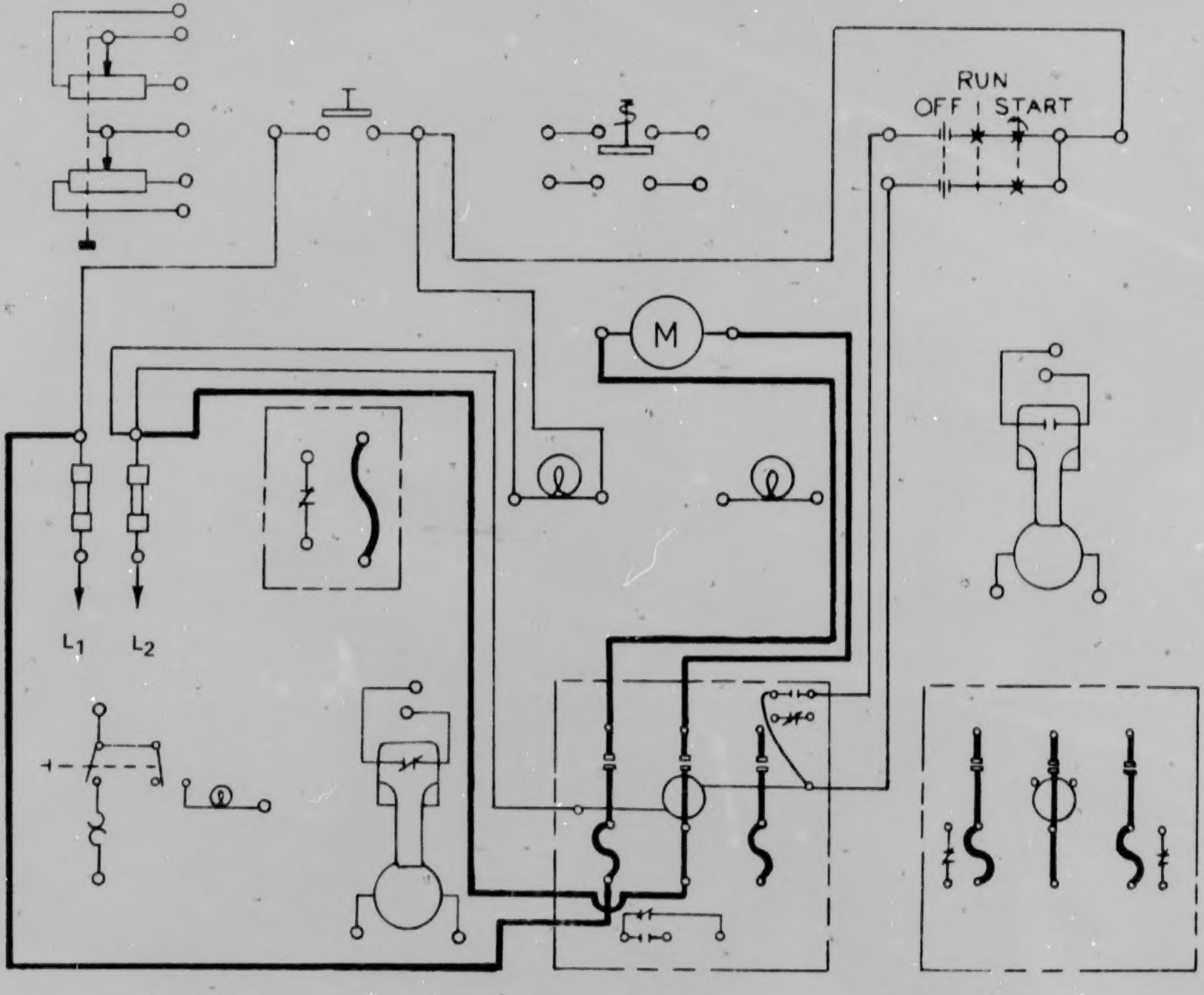
SAFETY PRECAUTIONS:
Disconnect power when wiring panel.
Visually check circuit before applying power
Keep hands away from energized panel.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) On student work sheet, draw control circuit from L_1 fuse to on-off switch to light bulb to L_2. From on-off switch to off-run-start to linestarter coil to L_2, from run to N.O. auxiliary contacts to coil. Draw power circuit from L_1 fuse through left linestarter contacts to motor lead, back through center contact tips to L_2.	SC 7 - 2 - 5
2) Disconnect power	
3) Wire circuit	NOTE: Circuit operation. Control switch "On" energizes light and run-start switch. Holding switch to "Start" energizes LS coil, motor runs and N.O. auxiliary contacts close. Release to "Run". Motor continues to run.
4) Visually check circuit.	
5) Energize panel. Demonstrate circuit	

METHOD OF EVALUATION:

Circuit drawing
panel wiring
circuit operation

DRAWING J - 7B - 4


RUN
OFF
START
M
L1
L2

JOB: Design and Build Circuit with Panic Switch **JOB NUMBER:** J · 7B · 5

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

MATERIAL: Basic A.C. Panel
Patch Cords
Student Work Sheets

EQUIPMENT:

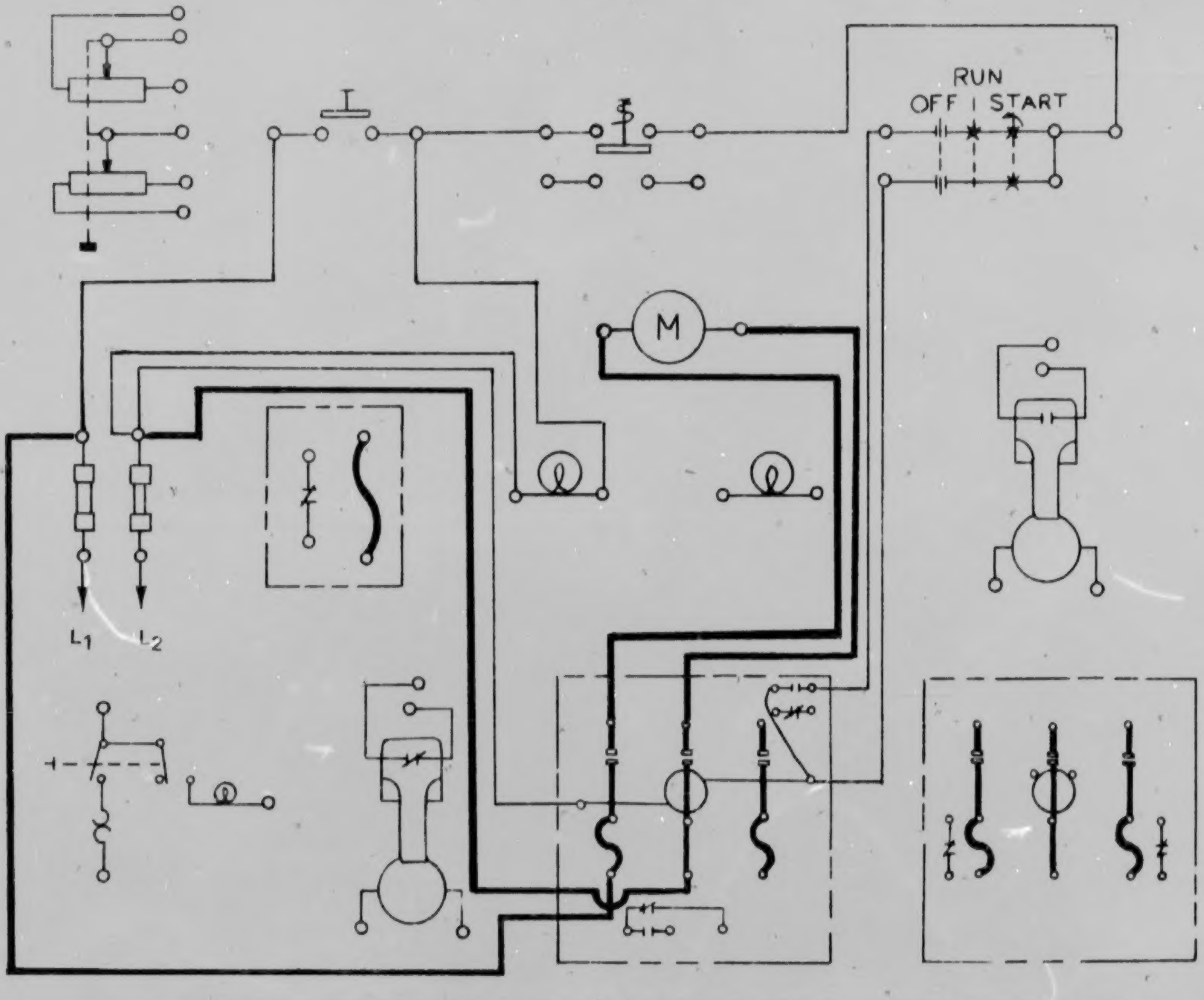
SAFETY PRECAUTIONS: Disconnect power when wiring panel
Visually check circuit before applying power
Keep hands away from energized panel

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) On student work sheet, draw control circuit L_1 fuse to on-off switch to light to L_2 on-off switch to normally closed push button switch to run-start switch. Start terminal to LS coil to L_2. Run terminal to N.O. auxiliary contact to LS coil. Draw power circuit from L_1 fuse to left LS contact to motor, back through center LS contact to L_2.	SC 7 · 2 · 5
2) Disconnect power	
3) Wire circuit	NOTE: Circuit operation. Control switch "ON" energizes light and run-start switch. Start position energizes LS coil causing motor to run and N.O. auxiliary contact to close. Release to Run position. N.O. contacts hold circuit. Pushing N.C. push-button "Panic Switch" de-energizes circuit. LS contacts open, motor stops.
4) Visually check circuit	
5) Energize panel. Demonstrate circuit	

METHOD OF EVALUATION:

Circuit drawing
Panel wiring
Circuit operation

DRAWING J - 7B - 5


RUN
OFF
START
M
L1
L2

JOB: Design and Build Circuit with Overload Protection **JOB NUMBER:** J - 7B - 6

UNIT: VII B Basic A.C. Circuits

COURSE: Mine Equipment Maintenance

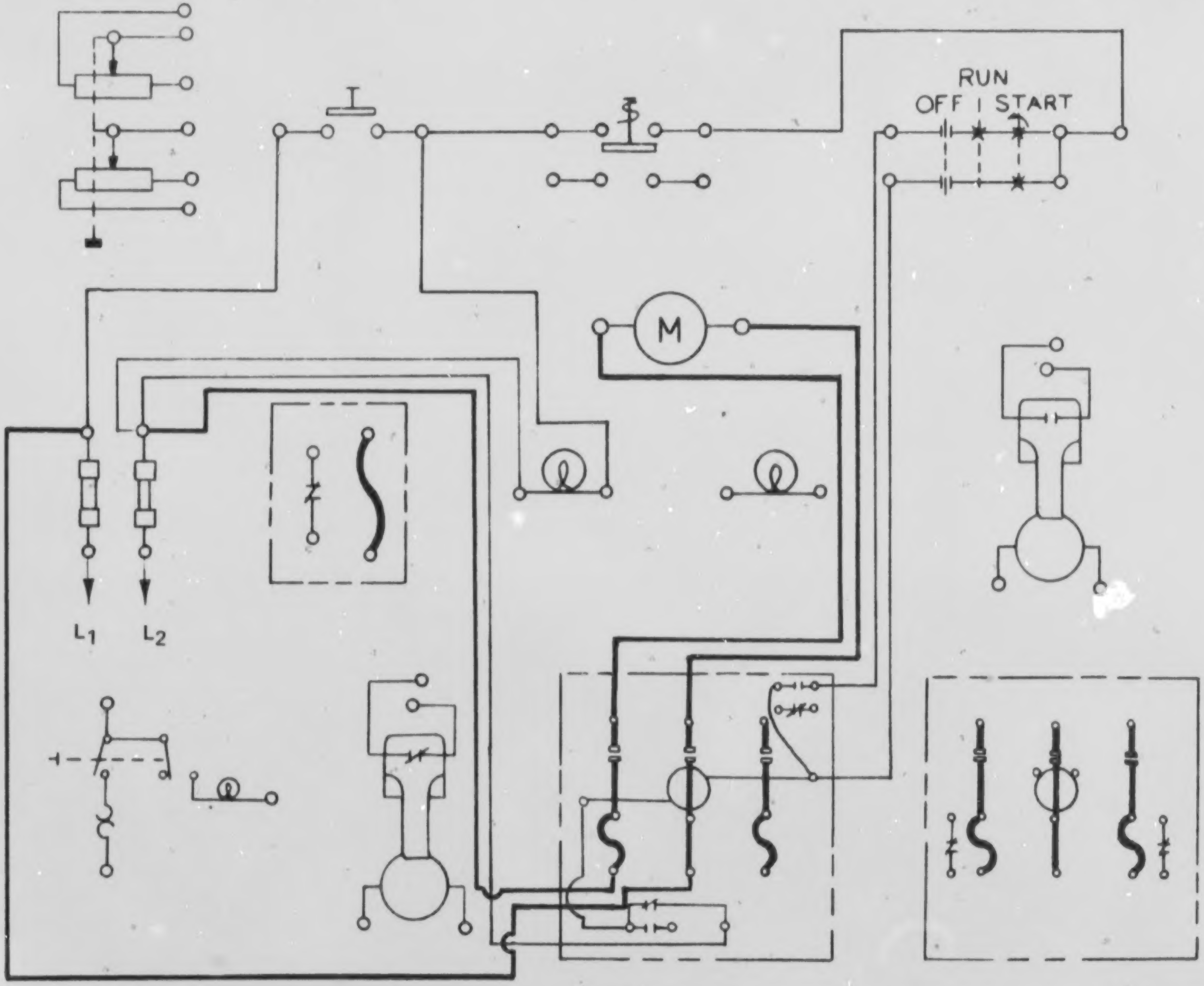
MATERIAL: Basic A.C. Training Panel
Patch Cords
Student Work Sheets

EQUIPMENT:

SAFETY PRECAUTIONS: Always disconnect power when wiring panel.
Visually check circuit before applying power
Keep hands away from energized panel

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) On student work sheets, draw control circuit from L_1 fuse to on-off switch to light to L_2, on-off switch to normally closed push-button switch to run-start switch. Start terminal to LS coil to N.C. overload contact to L_2.	SC 7 - 2 - 5
Draw power circuit from L_1 fuse to left LS contacts to motor, back through center LS contacts to L_2.	NOTE: Circuit operation. Control switch "On" energizes light and run-start switch. Start position energizes LS coil causing contacts to close and motor to run. N.O. electrical interlock closes. Releasing switch to Run position, N.O. contacts hold circuit. Overload in motor causes heater in left LS contact to open. N.C. overload contacts. Opening circuit to LS coil, de-energizing motor.
2) Disconnect power	
3) Wire circuit	
4) Visually check circuit	
5) Energize panel. Demonstrate circuit	

METHOD OF EVALUATION: Circuit drawing
Panel wiring
Circuit operation


RUN
OFF
START
M
L1
L2

JOB: Troubleshoot Circuit

JOB NUMBER: J - 7B - 7

UNIT: VII B Basic A.C. Circuit

COURSE: Mine Equipment Maintenance

MATERIAL: Basic A.C. Panel
Patch Cords
Circuit Diagram

EQUIPMENT: Voltmeter

SAFETY PRECAUTIONS: Disconnect power when wiring panel.
Visually check circuit before applying power
Keep hands away from energized terminals when making checks

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Put black lead of voltmeter on L_2.	SC 7 - 1 - 8
2) Using red probe, make step-by-step voltage checks, tracing through control circuit.	J 7 - 2 - 6
3) Locate defective component.	
4) Replace defective component.	
5) Test circuit operation	NOTE: There are many ways to install "bugs" in the circuit. Some suggestions are: - tape on contact tips - remove leads - insert blown fuse - insert "open" coil

METHOD OF EVALUATION: Ability to safely locate problem.
Repair of circuit

JOB: Draw D.C. Wiring Diagram Symbols **JOB NUMBER:** J 7 -3 -1

UNIT: VII C Direct Current Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Paper
Pencil

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
Draw elementary and schematic wiring diagram symbols for the following D.C. components: 1) Single Pole Contactor 2) Two-Pole Contactor with Mechanical Interlock 3) Normally Closed Mercury Switch 4) Instantaneous Overload 5) Motor Starting Resistor 6) Compound Wound Motor 7) Drum Switch	SC 7 - 3 - 1

METHOD OF EVALUATION:

Correct Symbols

JOB: Locate Components on Machine **JOB NUMBER:** J 7 - 3 - 2

UNIT: VII C D.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Schematic Wiring Diagram

EQUIPMENT: D.C. Mining Machine

SAFETY PRECAUTIONS: Be sure power is off machine
Use care when removing covers

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Secure from instructor a copy of the schematic wiring diagram. 2) Go to the machine. 3) Locate each component that the instructor has marked on the diagram. 4) On paper, write the name of the part, were it is located on the machine and how you know it is the part shown on the wiring diagram.	SC 7 - 3 - 2 NOTE TO INSTRUCTOR: Take copies of schematic wiring diagram for D.C. mining machine available to students. Mark 10 or 12 components with a colored pen. Have students locate components on the machine.

METHOD OF EVALUATION:

Location of components
Description of components
Description of technique used to verify identification

JOB: Repair a D.C. Contactor **JOB NUMBER:** J 7 - 3 - 3

UNIT: VII C D.C. Minine Machine

COURSE: Mine Equipment Maintenance

MATERIAL: D.C. Contactor
Spare Parts

EQUIPMENT: Wrenches
Screwdrivers
Allen Wrenches

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Remove arc chute. Check stationary contact tip if necessary.	SC 7 - 3 - 3 SC 7 - 3 - 4
2) Check moveable contact tip. Turn over if tip is pitted or burned.	
3) Clean top of armature to permit tight contact with coil core.	
4) Tighten contactor assembly bolts.	
5) Tighten armature hinge screw	
6) Adjust stop on contact tips for proper wiping action.	Refer to Section 3, A Training Program for Direct Current Mining Machinery
7) Reassemble contactor	
8) Tighten power connections.	

METHOD OF EVALUATION:

JOB: Repair D.C. Motor **JOB NUMBER:** J 7-3-4

UNIT: VII C D.C. Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: D.C. Motor

EQUIPMENT:
Wrenches
Screwdrivers
Allen Wrenches

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Remove end bells	SC 7-3-5
2) Remove brush assembly from commutator	
3) Remove armature	
4) Check armature coils	
5) Check field coils	
6) Replace armature	
7) Check bearings	
8) Replace brushes	
9) Adjust brushes for proper contact with armature	
10) Tighten connections	
11) Test motor	

METHOD OF EVALUATION:
Disassembly of motor
Assembly of motor
Adjustment of brushes
Test motor

JOB: Trace Pump Circuit on D.C. Loading Machine **JOB NUMBER:** J 7 - 3 - 5

UNIT: VII C D.C. Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram

EQUIPMENT: D.C. Loading Machine Training Panel

SAFETY PRECAUTIONS: Be sure power is off when wiring panel.
Keep hands away from energized connections.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Start pump motor on training panel by moving snap switch to Start position and holding until motor starts.	SC 7 - 3 - 7 SC 7 - 3 - 8
2) Trace the circuit on the wiring diagram and list each step.	
3) Develop a sequence chart for the contactors in the pump circuit.	
4) Identify the protective devices in the circuit.	

METHOD OF EVALUATION: Tracing circuit
Sequence Chart
Identification of Protective Devices

JOB: Troubleshoot Pump Circuit **JOB NUMBER:** J 7 - 3 - 6

UNIT: VII C D.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram
D.C. Loading Machine Training Panel

EQUIPMENT: Voltmeter

SAFETY PRECAUTIONS: Be sure power is off when wiring panel
Visually check circuits before applying power
Keep hands away from energized contacts when making checks

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Trace circuit on wiring diagram	SC 7 - 2 - 6
2) Take voltage reading at each step of circuit	J 7 - 2 - 6
3) Check sequencing of contactors	
4) Check switch	
5) Check overloads and auxiliary contacts	
6) Determine symptoms	
7) Determine possible causes for symptoms	
8) Locate fault and correct	
9) Develop troubleshooting check chart	NOTE: Instructor can insert variety of faults in circuit to give students practice in troubleshooting. See J 7 - 2 - 6 See sample check chart

METHOD OF EVALUATION: Locate fault
Repair fault
Develop check chart

JOB: Trace Head and Conveyor Circuit **JOB NUMBER:** J 7 - 3 - 7

UNIT: VII C D.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram

EQUIPMENT: D.C. Loading Machine Training Panel

SAFETY PRECAUTIONS: Be sure power is off when wiring panel
Keep hands away from energized connections

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Start the head and conveyor motor on the training panel by moving the snap switch to the Start position and holding until the motor starts. 2) Trace the circuit on the wiring diagram and list each step 3) Develop a sequence chart for the contactors in the head and conveyor circuit	SC 7 - 3 - 7 SC 7 - 3 - 8

METHOD OF EVALUATION: Tracing circuits
Sequence chart

JOB: Troubleshoot Head and Conveyor circuit **JOB NUMBER:** J 7-3-8

UNIT: VII C D.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram
D.C. Loading Machine Training Panel

EQUIPMENT: Volt-ohmmeter

SAFETY PRECAUTIONS: Be sure power is off when wiring panel
Visually check circuit before applying power
Keep hands away from energized contacts when making checks

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Trace circuit on wiring diagram	SC 7-2-6
2) Take voltage readins at each step of circuit	J 7-2-6
3) Check sequencing of contactors	
4) Check switch	
5) Check overloads and auxiliary contacts	
6) Determine sumptoms	
7) Determine possible causes	
8) Locate fault and correct	
9) Develop troubleshooting check chart	

METHOD OF EVALUATION: Locate fault
Repair fault
Develop check chart

JOB: Locate Components on Machine **JOB NUMBER:** J - 7D - 1

UNIT: VII D A.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Schematic Wiring Diagram

EQUIPMENT: A.C. Mining Machine
Wrenches

SAFETY PRECAUTIONS: Be sure power is off machine
Use care when removing covers

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Secure from instructor a schematic wiring diagram of machine.	SC 7 - 4 - 1
2. Go to machine and remove controller cover and master station case cover.	SC 7 - 4 - 8
3. Locate each component that the instructor has marked on the diagram.	
4. On paper, write the name of the part, where it is located on the machine, and how you know it is the part shown on the wiring diagram.	
5. Put the name of the part in masking tape and stick it to the part.	NOTE: Be sure to remove all masking tape from components after each student has completed this job.

METHOD OF EVALUATION: Location of components
Description of components and their locations
Tagging of components

JOB: Trace Motor Circuit **JOB NUMBER:** 7 - D - 2

UNIT: VII D A.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram

EQUIPMENT: A.C. Training Panel

SAFETY PRECAUTIONS: Be sure power is off when wiring panel.
Keep hands away from energized connections.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Start pump motor on training panel by moving snap switch to start position and holding until motor starts. 2. Observe contactors which close. 3. On wiring diagram, trace the circuit from the input through the pump motor switch to each contactor and to the motor. List and describe each step. 4. Develop a sequence chart for contactors and interlocks in the circuit. 5. Repeat the process for the other motors on the machine.	J - 7C - 5 SC 7 - 4 - 1 SC 7 - 3 - 8

METHOD OF EVALUATION: List and description of steps
Sequence chart

JOB: Troubleshoot Motor Circuit **JOB NUMBER:** J - 7D - 3

UNIT: VII D A.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram

EQUIPMENT: A.C. Training Panel
Volt Ohmmeter

SAFETY PRECAUTIONS: Be sure power is off when wiring panel. Visually check circuits before applying power. Keep hands away from energized contacts when making checks.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Trace circuit on wiring diagram	J - 7D - 2
2. Take voltage reading on training panel at each step of circuit.	J - 7C - 8
3. Check sequencing of contactors	
4. Check switch	
5. Check overloads and auxiliary contacts	
6. Determine symptoms of problem	
7. Determine causes of symptoms	
8. Locate fault and correct	
9. Develop troubleshooting check chart	

METHOD OF EVALUATION: Locate fault
Correct fault
Develop check chart
use safe practices

JOB: Repair A.C. Motor **JOB NUMBER:** J - 7D - 4

UNIT: VII D A.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: A.C. Motor Growler
Hand Tools
Volt Ohmmeter

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Remove end bells	SC 7 - 4 - 2
2. Disassemble motor	SC 7 - 4 - 3
3. Check windings	SC 7 - 4 - 4
4. Check brushes and collector rings	SC 7 - 4 - 5
5. Check bearings	SC 7 - 4 - 6
6. Repair or replace faulty parts	
7. Reassemble motor	
8. Determine lead markings.	

METHOD OF EVALUATION: Proper disassembly
Maintenance checks
Reassembly
Lead Identification

JOB: Repair Control Panel **JOB NUMBER:** J - 7D - 5

UNIT: VII D A.C. Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: Wire, Terminals, Tape, Schematic Wiring Diagram

EQUIPMENT: Hand Tools, Volt Ohmmeter, Control Panel

SAFETY PRECAUTIONS: Be sure power is off before working on panel.
Be sure not to damage permissible surfaces.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Remove controller case cover	SC 7 - 4 - 7
2. Remove panel from controller case	SC 7 - 4 - 8
3. Visually check panel for loose wires or signs of heat damage.	SC 7 - 4 - 9 SC 7 - 4 - 10
4. Replace any linestarters that have been identified as faulty.	~~SC 7 - 4 - 11~~
5. Replace electrical interlocks	
6. Replace time delays	
7. Replace wiring	
8. Check all terminations	
9. Visually check panel	
10. Trace circuits with elementary and schematic wiring diagram.	
11. Replace panel in controller and replace cover.	

METHOD OF EVALUATION: Proper disassembly
Proper checks and repairs
Proper reassembly

JOB: Repair Trailing Cable **JOB NUMBER:** J-7D-6

UNIT: VII D A.C. Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Trailing Cable
Splicing Kit
Insulation

EQUIPMENT: Splicer

SAFETY PRECAUTIONS: Be sure cable is disconnected from power source
Be careful with hot splicing equipment.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check cable for signs of excessive tension, mechanical damage, current overload. 2. Identify corrective action for above faults. 3. Make a temporary splice in a trailing cable.	SC 7-4-12 SC 7-4-13

METHOD OF EVALUATION: Proper checks
Proper correction
Good splice

JOB: Check Trailing Cable for Permissibility **JOB NUMBER:** J - 7E - 1

UNIT: VII E Permissibility

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Trailing Cable to piece of mining machinery

SAFETY PRECAUTIONS: Be sure machine is de-energized before checking cable.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check for proper short circuit protection.	J - 7D - 6
2. Check size, type and length of cable.	
3. Check for bad splices, exposed conductors or physical damage to cable.	
4. Note any temporary splice that has been in cable more than 24 hours.	
5. Check for MESA approval number.	
6. Check condition of strain clamp.	
7. Check condution of sheaves or rollers.	
8. Check reel tension	
9. Check cable reel and spooling device	See: Coal Mine Health and Safety Act "Schedule 2-G" Permissibility Check of Electric Face Equipment

METHOD OF EVALUATION:

Make all checks
Ability to recognize violations

JOB: Check Explosion Proof Compartments **JOB NUMBER:** J-7E-2

UNIT: VII E Permissibility

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Feeler Gauges
Mining Machine

SAFETY PRECAUTIONS: Be sure machine is de-energized

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Check all joints for excess clearances	SC 7-5-1
2. Look for missing bolts or lockwashers	SC 7-5-2
3. Be sure breathers are clean	SC 7-5-3
4. Examine inspection covers for damaged threads	SC 7-5-4
5. Look for holes burned in compartment.	SC 7-5-5
6. Be sure threaded joint covers are secured from loosening.	SC 7-5-6
7. Check packing glands.	
8. Check external wiring for damage or splices.	
9. Check guards and conduit	
10. Check headlights for loose or broken lens, loose packing glands, missing or broken locks.	
11. Test panic bar or emergency stop switch	See: "Schedule 2-G"

METHOD OF EVALUATION: Complete check lists
Ability to recognize violation

JOB: Make Overall Check of Machine **JOB NUMBER:** J - 7E - 3

UNIT: VII E Permissibility

COURSE: Mine Equipment Maintenance

MATERIAL:

EQUIPMENT: Mining Machine

SAFETY PRECAUTIONS: Be sure machine is de-energized

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Be sure MESA approval plate is attached to machine. 2. Look for unauthorized changes to permissible equipment. 3. Check for accumulation of coal dust, oil or other combustible material. 4. Check for ground fault protection. Check grounding diode. 5. Check for audible warning device on mobile equipment with top speed of 2.5 MPH or more. 6. Check for operable breaks. 7. Be sure headlights are in operating order. 8. Mobile equipment with top speed of 2.5 MPH must have red reflective material front and rear.	See: "Schedule 2-G"

METHOD OF EVALUATION:

Proper checks
Ability to recognize violations

JOB: Develop Block Model of AC/DC Circuit

JOB NUMBER: J - 7F - 1

UNIT: VII F AC/DC Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: Paper & Pencil

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Draw block diagram showing A.C. input to circuit breaker. 2. Show output of circuit breaker to A.C. switching. 3. Show output of A.C. switch to pump and conveyor motor. 4. Show output of A.C. switch to transformer. 5. Show output of transformer to A.C. power switching. 6. Show output of A.C. power switching to diode bridge. 7. Show output of diode bridge to bridge rectifier. 8. Show output of rectifier to D.C. no load switching. 9. Show output of D.C. switching to traction motors 10. Show logic box controlling timing and sequencing of A.C. power switching and D.C. no load switching.	

METHOD OF EVALUATION:

Accurate block diagram

JOB: Trace AC/DC Traction Circuit **JOB NUMBER:** J - 7F - 2

UNIT: VII F AC/DC Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: AC/DC Training Panel
Wiring Diagram

EQUIPMENT: Volt Ohmmeter

SAFETY PRECAUTIONS: Be sure power is off when wiring panel. Keep hands away-from energized contacts when making voltage checks

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Using wiring diagram, locate components on training panel.	SC 7 - 6 - 2
2. Trace control circuit through control transformer, switches to logic box.	SC 7 - 4 - 1 J - 7D - 2
3. Take voltage readings at each step.	
4. Operate all switch functions and take voltage readings at input and output terminals for each function on logic box.	
5. Trace control circuits from logic box to contactors.	
6. Trace power circuit through power transformer, contacts to diode bridge.	
7. Switch meter to D.C. scale.	
8. Trace circuit from diode bridge to D.C. motor	

METHOD OF EVALUATION:

Accurate tracing of circuit
Proper voltage readings

JOB: Replace Logic Box **JOB NUMBER:** J - 7F - 3

UNIT: VII F AC/DC Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: AC/DC Training Panel
Spare Logic Box

EQUIPMENT: Hand Tools
Voltmeter

SAFETY PRECAUTIONS: Be sure power if off before wiring box.
Keep hands away from energized contacts when taking voltage checks.

COMPETENCE – PROCEDURE/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Take voltage checks to isolate trouble.	SC 7 - 1 - 8
2. De-energize machine.	SC 7 - 2- 7
3. Remove terminal strips	SC 7 - 4 - 9
4. Remove box from panel.	SC 7 - 6 - 2
5. Check linestarter coils in faulted circuit for shorts.	
6. Isolate cause of failure and repair.	
7. Install new logic box.	
8. Attach terminal strips	
9. Test circuit	

METHOD OF EVALUATION:

Proper procedure
Checkfor cause of failure
Operable circuit

JOB: Replace Diodes **JOB NUMBER:** J-7F-4

UNIT: VII F AC/DC Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Diode set from AC/DC Training Panel

EQUIPMENT: Ohmmeter
Hand Tools

SAFETY PRECAUTIONS: Be sure power is off before taking resistance readings.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Disconnect power from panel	SC 7-6-1
2. Disconnect leads from top of diodes	SC 7-1-8
3. Take resistance reading in both directions through diodes.	
4. Identify faulty diodes	
5. Remove pair of diodes.(Always change in matched pairs.	
6. Locate new diodes with same direction of flow.	
7. Replace diodes in heat sink.	
8. Check with ohmmeter.	
9. Reconnect leads	

METHOD OF EVALUATION:

Proper technique
Safe Practices
Ability to locate faulted diodes

JOB: Develop Block Diagram of SCR Circuit **JOB NUMBER:** J - 7G - 1

UNIT: VII G SCR Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: Paper & Pencil

EQUIPMENT:

SAFETY PRECAUTIONS:

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Draw block diagram showing AC input to 1CB and 2CB circuit breakers. 2) Show output of 1CB to AC power switching and on to cutting motors. 3) Show output of 2CB to AC power switching and on to head motor. 4) Show another output of 2CB to AC power switching and on to pump motor. 5) Show output from pump motor switching to transformer. Then two legs to AC power switching, rectifier (SCR), DC no load switching, and traction motors. 6) Show logic box providing timing and sequencing to both legs of AC power switching and DC no load switching.	J - 7F - 1

METHOD OF EVALUATION: Accurate block diagram

JOB: Trace SCR Traction Circuit **JOB NUMBER:** J - 7G - 2

UNIT: VII G SCR Mining Machines

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram
SCR Training Panel

EQUIPMENT: Volt Ohmmeter

SAFETY PRECAUTIONS: Be sure power is off when wiring panel.
Keep hands away from energized contacts when making voltage checks.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using wiring diagram, locate components on training panel.	SC 7 - 6 - 2
2) Trace control circuit from control transformer, through switches, to logic box.	SC 7 - 4 - 1 J - 7D - 2
3) Take voltage readings to each step	J - 7F - 2
4) Operate switch functions and take voltage readings at input and output terminals of logic box	SC 7 - 7 - 2 SC 7 - 7 - 3
5) Trace control circuits from logic box to AC contactors and SCR firing package	
6) Trace power circuit from linebreaker through power transformer to contactors and SCR bridge.	
7) Trace control circuit from firing package to SCR's.	
8) Switch meter to DC scale.	
9) Trace circuit from SCR's to DC motors	

METHOD OF EVALUATION:

Accurate tracing of circuit.
Proper voltage readings.

JOB: Troubleshoot SCR Traction Circuit **JOB NUMBER:** J - 7G - 3

UNIT: VII G SCR Mining Machinery

COURSE: Mine Equipment Maintenance

MATERIAL: Wiring Diagram
Troubleshooting Diagram
Volt Ohmmeter

EQUIPMENT: SCR Training Panel

SAFETY PRECAUTIONS: Be sure power is off when wiring panel. Keep hands away from energized contacts when making voltage checks.

COMPETENCE – PROCEDURE/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Check line voltage on pump contactor to see that it is balanced 3-phase.	SC 7 - 1 - 8
2) Check secondary of control transformer for 120V AC.	
3) Check logic box power.	
4) Check high voltage on firing package. It should be same as No. 1 above.	SC 7 - 6 - 3
5) Operate switch functions and check for proper contactor sequencing.	SC 7 - 3 - 8
6) Check DC output at middle terminal of forward and reverse contactors.	
7) Check overloads.	SC 7 - 2 - 4
8) If contactors work but DC voltage is wrong -	SC 7 - 7 - 2
a) Physically check wiring	SC 7 - 7 - 3
b) Check logic box	SC 7 - 6 - 2
c) Check firing package	
d) Check gate voltage	
e) Check resistance values of power diodes and SCR's.	

METHOD OF EVALUATION: Sequence of checks
Ability to recognize faults
Safe work practices

OPERATION SHEET: SC 2-1-1

COMPETENCY: Identify and Demonstrate Seven (7) Ventilation Structures or Devices

COURSE: Mine Equipment Maintenance Unit: IIA Ventilation

OBJECTIVE: To identify and demonstrate structures and devices used in ventilation of a coal mine.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
Using the Table Top Model Mine, pick out each of the following items and demonstrate it's use.	
1) Line Curtain	IL 2-1-1
2) Temporary stopping	IL 2-1-2
3) Permanent stopping	IL 2-1-3
4) Check curtain	
5) Mandoor	
6) Regulator	
7) Overcast	

METHOD OF EVALUATION: Identification of Items
Demonstration of Use.

OPERATION SHEET: SC 2 - 1 - 2

COMPETENCY: Demonstrate Use of Map Symbols

COURSE: Mine Equipment Maintenance, **Unit:** IIA Ventilation

OBJECTIVE: To demonstrate symbols of mine ventilation for seven ventilation structures or devices.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
Using the student worksheet provided, take a blue colored pencil and mark in the symbols for following ventilation devices. 1) Line Curtains 2) Temporary stopping 3) Permanent stopping 4) Check curtains 5) Mandoor 6) Regulator 7) Overcast Using a red pencil, trace the air flow through the section.	IL 2 - 1 - 3 Text: Underground Mining Vol. I, Chapter 1.4 Slide-Tape Coal Mine Ventilation

METHOD OF EVALUATION: Accuracy of Symbols
Correct Air Flow

OPERATION SHEET: SC 2-1-3

COMPETENCY: Use of Vane Anemometer

COURSE: Mine Equipment Maintenance   Unit: IIA Ventilation

OBJECTIVE: To use a Vane Anemometer to accurately measure air velocity

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set dials to zero	
2. Face direction of air flow so air will enter back of instrument.	IL 2-1-5
3. Keep air flow through instrument free from obstructions.	
4. Turn instrument "On".	
5. Measure for one minute and read dials.	
6. Record dial readings.	

METHOD OF EVALUATION: Technique of Operation
Accuracy of Readings

OPERATION SHEET: SC 2-1-4

COMPETENCY: Calculate Air Flow

COURSE: Mine Equipment Maintenance Unit: IIA Ventilation

OBJECTIVE: Given anemometer readings and dimensions of entry, student will calculate air flow.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Take reading from anemometer dials and record velocity	
2. Determine area in square feet by multiplying height times width	IL 2-1-5
3. Calculate volume of air flow in cubic feet per minute by multiplying velocity of air times area of entry.	

METHOD OF EVALUATION: Method of Calculation
Accuracy of Calculation

OPERATION SHEET: SC 2-2-1

COMPETENCY: Identify Normal Mine Atmosphere

COURSE: Mine Equipment Maintenance Unit: IIB Mine Gases

OBJECTIVE: To write a description of normal mine atmosphere and those substances which could be hazardous to workers.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. List the gases normally found in the atmosphere and their proportions 2. List the gases in the atmosphere that are poisonous to man, and the concentrations at which they become hazardous. 3. List the sources of poisonous gases. 4. List the gases in the atmosphere that are explosive, and their explosive ranges. 5. List the sources of explosive gases.	IL 2-2-1 IL 2-2-2 IL 2-2-3

METHOD OF EVALUATION: Complete list
Accuracy of list

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OPERATION SHEET: SC 2-2-2

COMPETENCY: Demonstration of bulb type gas detectors

COURSE: Mine Equipment Maintenance Unit: IIB Mine Gases

OBJECTIVE: To select the proper detector for each type of poisonous gas and demonstrate its use.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Determine the gas to be measured.	
2. Select the correct measuring tube.	IL 2-2-4
3. Prepare the tube for use, and insert in the detector.	
4. Calibrate scale.	
5. Draw air sample into measuring tube.	
6. Compare indicator in tube to measuring scale on indicator.	
7. Determine concentration of gas.	

METHOD OF EVALUATION: Use of correct steps
Accuracy of measurements.

OPERATION SHEET: SC 2-2-3

COMPETENCY: Demonstrate Methane Detecting Instruments

COURSE: Mine Equipment Maintenance Unit: IIB Mine Gases

OBJECTIVE: To select the proper methane detecting device and demonstrate its use.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Select detecting instrument.	
2. Calibrate zero in fresh air.	
3. Take air sample into instrument.	IL 2-2-3
4. Read scale and record reading.	IL 2-2-4
5. Explain precautions to be taken when using this instrument to insure accurate reading.	

METHOD OF EVALUATION: Technique
Correct reading
Precautions taken

OPERATION SHEET: SC 2-2-4

COMPETENCY: Use of Flame Safety Lamp

COURSE: Mine Equipment Maintenance **Unit:** IIB Mine Gases

OBJECTIVE: To demonstrate the use of the flame safety lamp in detecting hazardous levels of methane gas and oxygen deficiency.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Examine lamp to insure that it is in safe working condition. 2. Light the lamp and adjust the flame to zero level in fresh air. 3. Using test cabinet, demonstrate method of detecting methane. 4. Demonstrate use of the flame safety lamp in determining oxygen deficiency. 5. List precautions to take when carrying and using the flame safety lamp.	IL 2-2-5

METHOD OF EVALUATION:
Proper use
Measurements
Precautions taken

OPERATION SHEET: SC 2-2-5

COMPETENCY: Remove hazardous gases

COURSE: Mine Equipment Maintenance Unit: IIB Mine Gases

OBJECTIVE: To initiate and carry out the correct procedure to remove hazardous gases and prevent injury to workers.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Stop mining operation and shut down machinery.	
2. Communicate danger to other workers and remove them from the area.	IL 2-2-1 IL 2-2-4
3. Locate the source of the hazardous gas.	IL 2-2-5
4. Change ventilation to dilute and remove the gas.	
5. Take periodic measurements to determine when safe level is reached.	SC 2-2-2 SC 2-2-3
6. Restore mining operation.	

METHOD OF EVALUATION: Communication with workers
Locate source of gas
Ventilation changes

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OPERATION SHEET: SC 2-3-1

COMPETENCY: Identify Types of Fires

COURSE: Mine Equipment Maintenance Unit: IIC Fires & Explosions

OBJECTIVE: To be able to identify the types of fires in order to select the correct extinguisher

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) List the three types of fires and their characteristics 2) List all of the combustible material found in a coal mine 3) Determine the type of fire for each material	IL 2-3-1

METHOD OF EVALUATION:

Types of fires
Combustible Material

OPERATION SHEET: SC 2-3-2

COMPETENCY: Demonstrate Use of Self Rescuer

COURSE: Mine Equipment Maintenance Unit: IIC Fires & Explosions

OBJECTIVE: To corectly use the self rescuer for protection from effects of carbon monoxide

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Slide rescuer to front of belt	IL 2-2-3
2) Pull lever on top of rescuer up, breaking seal	
3) Remove canister from belt	
4) Discard top	
5) Remove rescuer from bottom of canister	
6) Insert mouthpiece	
7) Put on nose clip	
8) Put on head strap	
9) Put on hard hat	
10) Breathe normally and head for fresh air	

METHOD OF EVALUATION:

Correct procedure

OPERATION SHEET: SC 2-3-3

COMPETENCY: Demonstrate Use of Fire Extinguisher

COURSE: Mine Equipment Maintenance Unit: IIC Fires & Explosions

OBJECTIVE: To select correct fire extinguisher and use it to extinguish fire

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Select correct extinguisher for type of fire being fought 2) Remove pin or seal 3) Point nozzle of base of flames 4) Squeeze trigger 5) Move nozzle in circular motion until all flames are extinguished	IL 2-3-1

METHOD OF EVALUATION:

Correct selection
Ability to extinguish fire

OPERATION SHEET: SC 2-3-4

COMPETENCY: Demonstrate the Barricading Method of Self Rescue

COURSE: Mine Equipment Maintenance   Unit: IIC Fires & Explosions

OBJECTIVE: To be able to construct a barricade for protection from irrespirable gases

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) List factors which would help a miner recognize an emergency	IL 2-3-2
2) Using the model mine, show the best location for a group of miners to barricade themselves	
3) Show the location for a temporary barricade, and list the materials that could be used	
4) Describe how to build a permanent barricade	
5) Explain the duties of the person in charge	

METHOD OF EVALUATION:

Recognize emergency
Best location of barricade
Techniques for construction

OPERATION SHEET: SC 2-4-1

COMPETENCY: Artificial Respiration

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: To demonstrate the ability to use mouth-to-mouth resusitation to treat patient who has stopped breathing

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Check breathing	IL 2-4-1
2) Lie victim on back	
3) Clear airway	
4) Lift head and pinch nostrils	
5) Breath into victim's mouth	
6) Watch for chest to rise	
7) Listen for return flow of air	
8) Continue until victim is able to breath on own	

METHOD OF EVALUATION:

Order of treatment
Correct application of technique

OPERATION SHEET: SC 2-4-2

COMPETENCY: Treatment for Shock

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate treatment for traumatic shock which frequently accompanies injuries

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Calm victim 2) Lay victim flat on back 3) Elevate feet six inches 4) Clear mouth of foreign objects 5) Loosen clothing 6) Keep victim warm and dry	IL 2-4-2

METHOD OF EVALUATION:

Order of treatment
Correct treatment

OPERATION SHEET: SC 2-4-3

COMPETENCY: Treatment of Burns

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate ability to properly treat victim of first, second and third degree burns

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Identify type of burn	IL 2-4-2
2) Cut away clothing from burned area	IL 2-4-9
3) If skin is broken by burn, cover with sterile gauze which has been dipped in solution of baking soda and cold water	IL 2-4-6
4) Apply burn dressing of four to six layers of gauze covered with loose bandage Note: Do not apply greasy or oily dressings to burns	
5) Treat for shock	

METHOD OF EVALUATION:

Order of treatment
Correct treatment

OPERATION SHEET: SC 2-4-4

COMPETENCY: Dressings for Fractures and Dislocations

COURSE: Mine Equipment Maintenance   Unit: IID First Aid

OBJECTIVE: Demonstrate ability to properly treat different types of fractures or dislocations

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Calm patient	IL 2-4-2
2) Determine location of fracture	IL 2-4-3
3) Immobilize injured limb	IL 2-4-6
4) Apply one of the following types of splint	IL 2-4-7
a) inflatable	
b) wooden	
c) rolled newspaper	
d) rolled blanket	
5) Treat victim for shock	

METHOD OF EVALUATION:

Order of treatment
Technique used

OPERATION SHEET: SC 2-4-5

COMPETENCY: Control of Bleeding

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate three different techniques used to control bleeding and explain their use

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Apply pressure directly to wounds with sterile dressing - Best method. May not be possible if wound is large	IL 2-4-4 IL 2-4-5
2) Apply pressure to artery at pressure point - Next best. Will slow bleeding enough to use direct pressure. * Do not hold pressure points in head or neck for more than 2 minutes without releasing pressure.	IL 2-4-6
3) Apply tourniquet around limb - Least desirable method. **Should only be used if uncontrolled bleeding threatens life of victim and cannot be stopped by other means	

METHOD OF EVALUATION:

Selecting proper technique
Application of proper techniques

OPERATION SHEET: SC 2-4-6

COMPETENCY: Use of Bandages

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate the proper use of bandages to cover injuries on each of the limbs of the body

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Apply bandage to head 2) Apply bandage to shoulder 3) Apply bandage to elbow 4) Apply bandage to hand 5) Apply bandage to hip 6) Apply bandage to knee 7) Apply bandage to foot	IL 2-4-6

METHOD OF EVALUATION:

Correct application of bandage
Neatness of bandage

180

OPERATION SHEET: SC 2-4-7

COMPETENCY: Moving and Handling Victim

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate the ability to properly transport an injury victim without complicating his injury

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Identify three types of stretchers - Folding stretcher - Basket (strokes) - Stretcher board or body board - Blanket & Pole Stretcher 2) Make a blanket & pole stretcher 3) Explain precautions to be taken when moving victim 4) Demonstrate 3-man lift to place victim on stretcher 5) Carry victim on stretcher	IL 2-4-8

METHOD OF EVALUATION:

Types of stretchers
Precautions
Technique of 3-man lift

OPERATION SHEET: SC 2-4-8

COMPETENCY: Immobilize Victim on Body Board

COURSE: Mine Equipment Maintenance Unit: IID First Aid

OBJECTIVE: Demonstrate ability to totally immobilize a victim securely on a body board for transportation

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Position victim on board without complicating injuries	IL 2-4-7
2) Immobilize head and neck	IL 2-4-8
3) Immobilize legs	
4) Immobilize torsoe	
5) Immobilize arms	
6) Transport victim	

METHOD OF EVALUATION:

Technique used
Effectiveness of immobilization

OPERATION SHEET: SC 2-5-1

COMPETENCY: Disassemble and Assemble Flame Safety Lamp

COURSE: Mine Equipment Maintenance Unit: II E Instruments

OBJECTIVE: To properly disassemble flame safety lamp for cleaning and maintenance and then reassemble to use

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Use magnet to unlock pins	IL 2-5-1
2) Remove bonnet	IL 2-5-2
3) Remove expansion ring, inner and outer gauzes, gaskets and globe	IL 2-5-3
4) Inspect parts for damage or wear.	
5) Disassemble igniter from font section	
6) Reassemble lamp in opposite order	

METHOD OF EVALUATION:

Order of disassembly
Care used in removing parts
Ability to reassemble

OPERATION SHEET: SC 2-5-2

COMPETENCY: Clean, adjust and fill Flame Safety Lamp

COURSE: Mine Equipment Maintenance Unit: II E Instruments

OBJECTIVE: To take flame safety lamp that has been disassembled, clean it, fill the fuel font, and make the necessary adjustments

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Clean and adjust igniter	IL 2-5-2
2) Replace flint	IL 2-5-3
3) Clean and trim wick	
4) Adjust wick raising device	
5) Fill font with naptha (Do not overfill)	
6) Clean gauzes with soft bass bristle brush	
7) Inspect gauzes for holes of broken wires	
8) Check gauze ring and globe	
9) Clean globe and bonnet	

METHOD OF EVALUATION:

OPERATION SHEET: SC 2-5-3

COMPETENCY: Light and Calibrate Flame Safety Lamp

COURSE: Mine Equipment Maintenance Unit: II E Instruments

OBJECTIVE: To light a flame safety lamp and correctly calibrate in fresh air before use underground

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Extend the wick 2) Elevate the igniting device 3) Rotate the igniter, producing spark in light wick 4) Adjust flame in fresh air to mark on globe 5) Place lamp in gas chamber with known concentration of methane and note change in flame 6) Place lamp in chamber with low oxygen concentration and observe change	IL 2-5-2 IL 2-5-3

METHOD OF EVALUATION:

Ability to light lamp
Proper zero adjustment

OPERATION SHEET: SC 2-5-4

COMPETENCY: Check and Recharge Battery

COURSE: Mine Equipment Maintenance   Unit: II E Instruments

OBJECTIVE: To be able to check the battery voltage on a methane detector and recharge the battery

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Check mechanical zero to be sure needle rests on zero	IL 2-5-4
2) Push test button and check button. Hold until needle stops moving	IL 2-5-5
3) Look at meter scale to see if needle stays in area indicating battery condition	
4) Remove cover from battery charger connection	Note: There are many types of methane detecting devices. Refer to manufacturer's instructions for location of test button, battery condition meter, and charger connection
5) Attach battery change for prescribed period of time	
6) Recheck battery	

METHOD OF EVALUATION:

Mechanical sero check
Electrical zero check
Charge battery

OPERATION SHEET: SC 2-5-5

COMPETENCY: Check and Adjust Electrical Zero

COURSE: Mine Equipment Maintenance Unit: II E Instruments

OBJECTIVE: To be able to check the electrical zero on a methane detector and adjust the meter

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Push test button and draw pure air sample into instrument 2) Check position of needle. It should stop on zero 3) If needle does not stop on zero, use small screwdriver to adjust electrical zero potentiometer 4) Recheck 5) Take sample of methane of known concentration in test chamber. Read scale to insure correct reading.	

METHOD OF EVALUATION:

OPERATION SHEET: SL 3 - 1 - 1

COMPETENCY: Test and Scale Roof

COURSE: Mine Equipment Maintenance

OBJECTIVE: Determine whether immediate roof is safe by the sound and vibration method. Remove loose material from the roof.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select a special testing rod, usually a wood handle topped by a heavy metal cap. 2. Rest the tips of the fingers on the roof. Gloves should be removed for this sequence. 3. Strike the roof several times with the special testing rod. 4. Listen for a dull or hollow sound accompanied by vibration. This indicates a loose roof. 5. Listen for a solid ring which indicates a good top. 6. Remove loose material from the roof with a pry or slate bar.	Note: There are kinds of roof where this testing method is not reliable.

METHOD OF EVALUATION:

Instructor observation and testing known structure.

OPERATION SHEET: SC 3 - 1 - 2

COMPETENCY: Set Props or Posts

COURSE: Mine Equipment Maintenance

OBJECTIVE: Set or install vertical timbers to support the roof.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Measure distance between floor and roof. 2. Select a well dried timber, free of knots and other imperfections. Posts must be a minimum of 4 inches in diameter and not less than 1 inch for each 15 inches of length 3. Place a wooden footer at the desired location underneath the prop. This footer should have flat parallel sides, and not less than 2 inches in thickness, 4 inches wide and 12 inches long. 4. Place a wooden cap block upon the vertical prop. The same dimensions as the footer apply to the cap block. 5. Insert no more than two wedges between the prop and cap block to tighten the post.	Note: Occasionally props or posts are set loosely where downward movement of the roof or heaving is imminent.

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SC 3 - 1 - 3

COMPETENCY: Install Crossbars and Beams

COURSE: Mine Equipment Maintenance

OBJECTIVE: Install horizontal crossbars and beams for added roof support.

COMPETENCE -- PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select either a wooden beam (header) or metal crossbars. Crossbars should have a minimum cross-sectional area of 24 inches and a minimum thickness of 3 inches. 2. Raise the beam on crossbar to the roof. This is normally done with a mining machine, or hydraulic/mechanical jacks. 3. Place the beam or crossbar across two support members. These are usually props or cribs. 4. Insert wedges between the prop/crib and the beam or crossbar to insure a tight fit. 5. Secure the beams with roof bolts on four foot centers for added support and to prevent injury if a post is knocked down from under the crossbar.	Note: Steel or aluminum crossbars will support a higher load perpendicular to its long axis than wooden headers.

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SC 3 - 1 - 4

COMPETENCY: Construct Cribs

COURSE: Mine Equipment Maintenance

OBJECTIVE: Erect cribs for extra roof support in both temporary and permanent situations.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Determine the need for additional roof support, e.g., large openings, to remove squeeze burden on pillars, etc. 2. Select either round or square timbers. 3. Notch or pin round timbers. 4. Construct the crib in an overlapping method. That is, build the crib in a square configuration - two parallel timbers and then two parallel timbers placed on top of the two previous ones in the opposite direction to create a square. 5. Insure the crib is perpendicular to the floor in order to support the roof on the entire crib area. 6. Pack rock or slate in the crib if it is to be permanent. Place wedges between the crib and roof to tighten the juncture. 7. Continue building until space is consumed between the crib and roof.	Note: Cribs should not be used in pillar extraction or where the roof is expected to fall later. It is almost impossible to remove cribs at a later time and the partial support of the roof at these points can place undue pressure on adjacent roof.

METHOD OF EVALUATION:

COMPETENCY: Bolt a Roof

COURSE: Mine Equipment Maintenance

OBJECTIVE: To anchor a weak immediate roof to a strong firm structure above and/or bind several layers of weak strata into a beam to support its own weight.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set temporary roof supports. 2. Spot roof drill under the desired location. 3. Drill hole to desired depth. 4. Withdraw drill from hole. 5. Insert plug, shell and bolt through the hardened steel washer and the plate washer. Then insert shell end of bolt as far into the hole as possible. 6. Tighten bolt head with a power wrench, thereby expanding the shell and anchoring it.	Note: This operation sheet details the installation of a roof bolt having an expansion shell and a headed bolt. Other means not covered include a slot and plug instead of a separate shell, and a roof bolt having a resin anchor. Roof bolts vary in length from 30 inches to 10 foot, depending upon the overlying strata.

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SL 3-2-1

COMPETENCY: Install supports for Brattice and Tubing

COURSE: Mine Equipment Maintenance Unit: III Internal Mine Construction

OBJECTIVE: Install spads and tabs with a spad gun to support brattice and tubing.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Unlock the setscrew on the barrel to permit the handle and the rod inside the barrel to move downward.	IL 3-2-1 Brattice and Tubing
2) Insert the spad into the end of the barrel, with the point facing outward.	
3) Place the tab slot over the point of the spad, and push the tab until its rim is over the barrel driven head.	NOTE: Hangers are often suspended from spads to support ventilation tubing, pipes or wires.
4) Run the spad through the plastic brattice cloth (18 inches apart) at a grommet.	
5) Reciprocate the handle of the spad gun back and forth to drive the spad.	

METHOD OF EVALUATION: Instructor observation and testing.

OPERATION SHEET: SL 3-2-2

COMPETENCY: Install Ventilation Tubes and Couplings

COURSE: Mine Equipment Maintenance Unit: III Internal Mine Construction

OBJECTIVE: Fabricate and install ventilation tubes and couplings for auxiliary ventilation.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Suspend tubing from roof or ribs from hangers attached to spads.	IL 3-2-1
2) Place the end of one tube into another of similar diameter to begin the couplings on one common type of tubing. External couplings are not necessary.	
3) Squeeze the ring of one tube (the lip at the end of the tube) slightly and slip it past the rim of the other tube.	
4) Pull the tubes apart until the rings at the tip of each tube are against one another.	NOTE: Separate couplings have an advantage over sewed-in ones. In the event of damage only the damaged part has to be removed for repair or replacement.
5) Place a piece of tubing in position and slip one-half of an external coupling over it. This procedure is used when sewed-in couplings are not used.	
6) Slip the connecting piece of tubing into the other half of external coupling.	
7) Secure hands-on coupling with a bolt and a wing nut.	

METHOD OF EVALUATION: Instructor observation and testing

OPERATION SHEET: SL 3-2-3

COMPETENCY: Construct Masonary Stoppings

COURSE: Mine Equipment Maintenance Unit: III Internal Mine Construction

OBJECTIVE: Effectively seal crosscuts as mining proceeds along an entry.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Make shallow cuts into the ribs, roof and floor of the crosscuts. Deep footings are necessary where freezing temperatures prevail.	IL 3-2-2
2) Cut the floor for the footing twice as wide as the wall it is to support.	
3) Mix concrete with aggregate for the footer.	
4) Pour cement in footer and level before it hardens. Let harden for two days.	
5) Mix monitor in a quantity sufficient to lay first row of blocks on footer.	
6) Spread a bed of mortar on top of the footing.	
7) Set the first block on end and spread mortar on the end that is up. Put the block in place on the footing and against the rib.	
8) Proceed the second and subsequent blocks in the same manner. Joints between blocks should be 1/4 to 3/8 inch thick.	
9) Align and level each two or three blocks laid.	
10) Continue adding blocks to the first course until it extends across the footer into the rib.	
11) Begin laying the second and subsequent rows of blocks after the first row has hardened for two days. Stagger the rows with half blocks.	
12) Continue laying blocks until the wall is to its required height.	

METHOD OF EVALUATION:

Instructor observation and testing

OPERATION SHEET: SL 3-2-3

COMPETENCY: Construct Masonary Stoppings (continued)

COURSE:

OBJECTIVE:

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
13) Tie wall into roof of the mine. Cap the top of the stopping with wire mesh or some other material. Concrete or mortar is then troweled into place above the cap up into the roof.	

METHOD OF EVALUATION:

OPERATION SHEET: SL 3-2-4

COMPETENCY: Erect Metal Stoppings

COURSE: Mine Equipment Maintenance Unit: III Internal Mine Construction

OBJECTIVE: Effectively seal crosscuts as mining proceeds along an entry.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Place two or more horizontally positioned frames into the rib on each side.	IL 3-2-2
2) Attach vertical panels to the horizontal frame. Begin this procedure at rib and proceed across to the next rib.	
3) Extend the vertical panels upward or downward to fit against the roof and bottom configuration.	
4) Overlap one panel with another in cases where the drift has an irregular shape such as the top being narrower than the bottom.	
5) Tighten panels in place to complete stopping.	NOTE: Various end plate configurations are available to accommodate irregular ribs, e.g., cut with a twinbore continuous miner.

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SL 3-2-5

COMPETENCY: Seal Masonary and Metal Stoppings.

COURSE: Mine Equipment Maintenance　　Unit: III Internal Mine Construction

OBJECTIVE: Prevention of air leakage through a concrete or metal stopping.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Seal joints and other openings with a sealer gun which is similar to an ordinary caulking gun. 2) Cover the concrete stopping with a sealant since concrete is porous. The following methods can be used but are not advisable since they are either flammable or toxic when exposed to heat: plastic and tar spraying. 3) Spray cement stoppings with Mandoseal instead of the preceding. It is a non-toxic and non-flammable material. 4) Spray metal stopping joints and openings with Mandoseal.	IL 3-2-3

METHOD OF EVALUATION:
Instructor evaluation and observation

OPERATION SHEET: SL 3-2-6

COMPETENCY: Construct Concrete and Metal Overcasts

COURSE: Mine Equipment Maintenance | Unit: III - Internal Mine Construction

OBJECTIVE: Construct an air tight bridge to permit crossing of intake and return airways without interference.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Build two concrete block walls set in mortar parallel to the ribs of one entry. Theee walls should be about two thirds.	IL 3-2-3
2) Construct wing sections which are approximately at a 45 degree angle with the two walls. These are firmly anchored to the corners of the intersection.	
3) Place steel beams from one wall to the other.	
4) Construct a concrete block roof set in nortar on top of the beams.	
5) Build two walls at right angles to the lower two walls. These walls are parallel to the steel beams and also have wings at each end.	
6) Cut away the roof of the top entry to provide a cross-sectional area two thirds the area of the original entry.	NOTE: See back of this sheet for schematic drawing of an overcast.
7) Backfill the area next to the lower walls to provide air flow streaming in the overcast.	

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SL 3-3-1

COMPETENCY: Prepare a Roadbed with Uniform Grades.

COURSE: Mine Equipment Maintenance **Unit:** III - Internal Mine Construction

OBJECTIVE: Provide a water free and reduced maintenance roadbed for laying main haulageway track.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1) Survey the intended roadbed area to insure uniformity. 2) Remove dips and/or bumps by filling. 3) Deposit ballast in roadbed. Ballast is referred to here as crushed stone. The depth of ballast should be determined by the mine engineer. Normally, the depth is determined by the loads to be carried and the speed of the cars. 4) Construct ditching alongside the roadbed if a water problem exists in the mine. 5) Place ashes or planking on top of the ballast to retard tracking sinking where the floor is soft or moist.	

METHOD OF EVALUATION:

Instructor testing and/or observation.

OPERATION SHEET: SL 3-3-2

COMPETENCY: Align Tracks on a Roadbed

COURSE: Mine Equipment Maintenance Unit: III - Internal Mine Construction

OBJECTIVE: Provide safe clearance and elevation on curves and turnouts.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES

1) Insure a clearance of 30 inches is used on the inside rib of a curve and a minimum of 12 inches is used on the outside rib. This is determined by the overhang (between wheels and end of locomotive) of the largest vehicle, normally the locomotive.
2) Determine minimum radii of a curve. Divide the wheel base of the locomotive in inches by two to arrive at the minimum track radii in feet. For high speed haulage, the minimum radii should be 200 feet.
3) Calculate the elevation of the outer rail on curves, according to the chart on the back of this sheet. If the gauge is larger or smaller than 36 gauge, place the gauge in the numerator of the fraction. The denominator is 36. Multiply this fraction times the indicated elevation for the correct elevation for a gauge.

Elevation of Outer Rail on Curves
(For 36-inch track gauge.)

Radius of Curve in Feet	4 mph	6 mph	8 mph	10 mph	12 mph
35	1.54	3.42	6.13	9.59	13.80
30	1.30	2.84	5.10	8.00	11.46
35	1.10	2.43	4.38	6.86	9.85
60	0.644	1.42	2.56	4.00	5.75
80	0.479	1.06	1.93	3.00	4.32
100	0.385	0.854	1.53	2.40	3.44
200		0.427	0.765	1.21	1.72

METHOD OF EVALUATION:

Student testing.

OPERATION SHEET: SL 3-3-3

COMPETENCY: Space, Spike and Join Track

COURSE: Mine Equipment Maintenance **Unit:** III - Internal Mine Construction

OBJECTIVE: Lay track and secure in a safe, reduced maintenance manner.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Space ties on the railbed at 20 - 21 inch intervals. Excessive spacing can cause the rails to break and on soft bottom very close spacing is used.	IL 3-3-1
2) Lay track to insure that joints will be between two ties and not on one tie.	
3) Fasten tracks to ties with spikes. Two spikes straddle each track and are staggered. The spike on the outside track should be toward the direction from which the loads will come.	
4) Splice track. Splice bars are bolted to the end of each track. Splice bars have four or six holes depending upon the size of the track. These holes line up with holes in the track.	
5) Bond track with a short piece of cable or weld track to provide a low resistance path for electricity when track is used as a return line.	

METHOD OF EVALUATION:

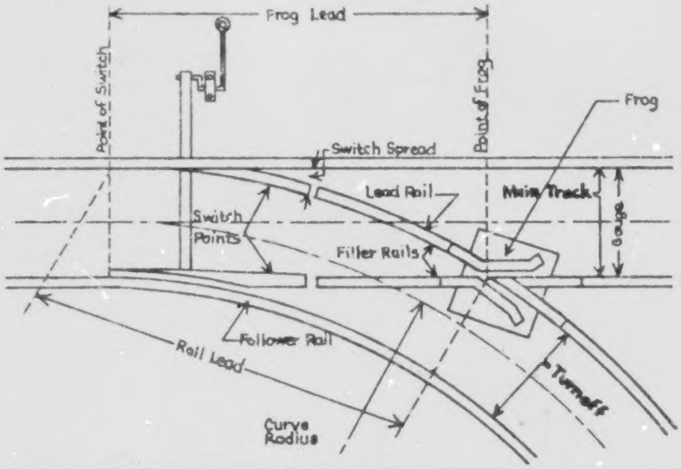
Instructor observation and/or student testing.

OPERATION SHEET: SL 3-3-4

COMPETENCY: Install Switches

COURSE: Mine Equipment Maintenance Unit: III - Internal Mine Construction

OBJECTIVE: Connect one set of tracks with one or more sets of tracks.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Install the outside straight track. This is the straight track that will meet with the outside curved track.	IL 3-3-2
2) Place the inside curved track in place. This track is called the follower rail.	
3) Install the switch points assembly. This consists of the switch points assembly, the framework they are mounted on, and the switch throwing mechanism.	
4) Place the frog and the two pieces of track between it and the switch in position. These two pieces of track are called filler rails and the curved one is called the lead rail.	
5) Insure the follower rail is located one gauge length or slightly more inside of the lead rail.	NOTE: See illustration on back of sheet
 Frog Lead Point of Switch Point of Frog Frog Switch Spread Lead Rail Main Track Gauge Switch Points Filler Rails Follower Rail Rail Lead Curve Radius Turnout	

METHOD OF EVALUATION:

OPERATION SHEET: SL 3-3-5

COMPETENCY: Maintain Tracks and Trolleys in a Safe Manner

COURSE: Mine Equipment Maintenance

OBJECTIVE: Insure tracks and trolleys are kept in an operable and safe condition.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Maintain ballast to a point approximately up to the level of the top of the ties. Hard stone such as granite and limestone should be used.	IL 3-3-4
2) Replace rotten ties, particularly if two or three bad ones are next to one another.	
3) Insure track joints are secure. Loose splice plates should be tightened. Welded track joints should be checked for cracks or crystallization. Track spikes should be tightened if loose.	
4) Replace trolley archers which show signs of acring across the insulated bushing.	
5) Maintain trolley lines at a minimum of five feet above the track.	
6) Replace guards on both sides of all doors and stopping, and at all mantrip stations.	

METHOD OF EVALUATION:

Instructor observation and/or student testing.

OPERATION SHEET: SL 3-3-6

COMPETENCY: Install Trolley Wire

COURSE: Mine Equipment Maintenance

UNIT: III - Internal Mine Construction

OBJECTIVE: To provide power to electrically drive underground track mounted vehicles.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Install fixtures six inches outboard the rail at intervals of 24 feet. On curves the spacing must be closer. Screw fixtures into the roof.	IL 3-3-5
2. Connect trolley wires to the fixtures with a clamp to the crossbar of the fixtures.	
3. Install frogs on switches at the branch circuit of trolley lines.	
4. Install guard boards at the end and intersections of trolley line. These are made of a rubber-like material or wood and should extend along five or six feet of trolley wire.	
5. Securely anchor and insulate ends of trolley wire. The anchor should be separated from the trolley wire by an insulated turnbuckle.	NOTE: Installation of trolley wires and feeder lines should be done only when electrical current is turned OFF and so designated.

METHOD OF EVALUATION:

Instructor observation and testing.

COMPETENCY: Operate a Pump

COURSE: Mine Equipment Maintenance **Unit:** III - Internal Mine Construction

OBJECTIVE: Operate a pump to remove water accumulations in a mine

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Insure drain plugs in the pump or the connected piping are closed.	
2. Check oil level in pump reservoir.	
3. Inspect pump to see that all nuts and bolts are tight.	
4. Turn pump shaft or pulley wheel by hand a few times - this insures everything is free to move.	
5. Insure inlet and outlet valves in the suction line are open.	
6. Insure there is no pressure in the discharge line by pressing the relief valve.	
7. Start pump motor. Insure pump is running at correct speed.	
8. Run pump until water discharges. Check speed against manufacturer's specifications.	

METHOD OF EVALUATION:

OPERATION SHEET: SL 3-4-2

COMPETENCY: Install Pumps

COURSE: Mine Equipment Maintenance **Unit:** III - Internal Mine Construction

OBJECTIVE: Remove water from mines through the use of pumps

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Position pump and electric motor (mounted on skid) on a level floor.	IL 3-4-3
2. Install, if not present, a relief valve in the discharge pipe of the pump. This will prevent damage to the pump in the event that the discharge pipe becomes blocked.	
3. Insure shielded AC power is available to the pump motor. Connect AC power.	
4. Connect suction piping to the pump. It should be the same size or larger than the suction inlet of the pump.	
5. Cover the suction line inlet with a strainer. The strainer should have an area three to four times the cross-section of the suction pipe.	
6. Connect the discharge line in a straight line to avoid extra strain on the pump bearings.	

METHOD OF EVALUATION: Instructor testing and/or observation.

OPERATION SHEET: SL 3-4-3

COMPETENCY: Preventive Maintenance for Pumps

COURSE: Mine Equipment Maintenance

OBJECTIVE: Maintain pumps through a preventive maintenance program

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Check periodically the oil level of the pump in the reservoir. The oil level when the pump is operating will normally be less than when the pump is stopped.	
2. Add oil of 30 weight, if necessary. Using lightweight or heavy oils can result in damage to the pump	
3. Grease grease fittings at least once a month with a quality 90 weight viscosity grease.	
4. Replace motors with one of the same horsepower and speed.	
5. Check periodically packing glands for leakage. If leaking, tighten by hand. If this does not eliminate leakage, replace packing.	

METHOD OF EVALUATION: Instructor observation and/or testing.

OPERATION SHEET: SL 3-4-4

COMPETENCY: Installing Piping

COURSE: Mine Equipment Maintenance — **Unit:** III - Internal Mine Construction

OBJECTIVE: Install gathering lines in an efficient low maintenance manner.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Examine pipe ends for burrs and dents. 2. Brush or wipe on a thin uniform coat of lubricant either on the gasket lips and outside, or on the pipe ends and circumference as well as the inside of the coupling. 3. Place the gasket on one pipe. Insure it does not extend past the end. 4. Bring the pipe ends together and center the gasket between the two pipes. 5. Place the two half circle clamps over the gasket and pipe ends. 6. Insert bolts and tighten nuts evenly. Uneven tightening can pinch gaskets.	NOTE: Pipe lines should not be used as a ground for electrical systems.

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4 - 1 - 1

COMPETENCY: Use a dynamite punch

COURSE: Mine Equipment Maintenance

Unit: IV - Mine Procedures, Machinery and Equipment

OBJECTIVE: Properly insert a primer in an explosive.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Punch a hole into the end of the primer cartridge. Use a dynamite punch - a pointed rod made of wood, brass, aluminum or other non-sparking material.	IL 4 - 1 - 4
2. Insert the pin one-half inch longer than the longest detonator used, and wide enough to allow easy insertion of the detonator cap and wires.	
3. Insert wires into punched holes.	
4. Keep wires shunted until ready for connection.	NOTE: Safety fuse and caps are not permissible in coal mines.

METHOD OF EVALUATION:

Instructor observation and testing.

OPERATION SHEET: SL 4-1-2

COMPETENCY: Secure wires to a primer cartridge

COURSE: Mine Equipment Maintenance

Unit: IV – Mine Procedures, Machinery and Equipment

OBJECTIVE: Prevent electrical leg wires coming loose when the primer cartridge is inserted into the drill hole.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Fasten leg wires to the primer cartridge with a half-hitch around the middle of the cartridge and lightly pull to secure.	IL 4-1-4
2. Punch a second hole in the primar cartridge at right angles to its long axis. The doubled over leg wires are pushed through the hole, and then looped around the bottom of the cartridge. This is an alternate, but more time comsuming method.	

METHOD OF EVALUATION: Instructor observation and/or testing.

OPERATION SHEET: SL 4 - 1 - 3

COMPETENCY: Charge a Drill Hole

COURSE: Mine Equipment Maintenance

Unit: IV - Mine Procedures, Machinery and Equipment

OBJECTIVE: To charge a drill hole correctly to have an effective explosion.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Remove all dirt and grit from the drill hole. A metal scraper (no more than 8 inches long) mounted on a wooden tamping stick can be used.	IL 4 - 1 - 5
2. Place the primer cartridge first in the drill hole. The detonator end faces the back of the drill hole.	
3. Insert the next cartridge and continue until the correct charge has been placed.	
4. Push all the cartridges to the back of the hole.	NOTE: It is important the cartridges are inserted in the drill hole without gaps or solid material between them.

METHOD OF EVALUATION: Instructor observation and/or testing.

OPERATION SHEET: SL 4 - 1 - 4

COMPETENCY: Tamp a Drill Hole

COURSE: Mine Equipment Maintenance

Unit: IV - Mine Procedures, Machinery and Equipment

OBJECTIVE: To plug the hole after the charge is in place.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Insert tamping material up to the beginning of the last charge. Ideal material includes water stemming bags and rock dust, packaged in sausage-shaped bags.	IL 4 - 1 - 5
2. Continue inserting tamping material until the hole is filled.	
3. Insure the tamping is dense and firmly set in place.	NOTE: Stemming also has an important function of helping to quench the flame of detonation. Loose, light materials are not suitable for stemming.

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-5

COMPETENCY: Fabricate a Series of Firing Circuits

COURSE: Mine Equipment Maintenance

OBJECTIVE: To fabricate firing circuits for a group of detonators

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Connect the leg wires of the detonator to an insulated two-conductor shooting cable at least 100 feet long. 2. Continue the circuit by connecting the next detonator's leg wires to the shooting cable. Continue this procedure until the specified number of detontators is completed. 3. Connect the shooting cable to the permissible blasting machine only at the time when ready to blast.	IL 4-1-6 NOTE: Not considered reliable if more than 50 caps are to be detonated. A parallel circuit should be used for larger quantities of caps if a larger current source is available.

METHOD OF EVALUATION:

Instructor observation and/or testing

OPERATION SHEET: SL 4-1-6

COMPETENCY: Testing a Series Circuit

COURSE: Mine Equipment Maintenance　**Unit:** IV Mine Procedures, Machinery and Equipment

OBJECTIVE: To test a circuit to measure the circuit resistance, or whether a circuit is complete and in proper condition for firing.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Calculate the resistance of the circuit. An electric blasting cap with 10 feet of leg wire have a resistance of 1.51 ohms. Number 20 copper shooting wire has a resistance of 1.015 ohms. Thus, adding the number of blasting caps with the length of shooting cable will provide the total resistance of a series circuit. 2. Connect a galvanometer to the two leads of the shooting cable. 3. Test the circuit. If the resistance is less than the calculated resistance, it indicates that one of the caps has been omitted or that one or more caps has a short. Greater resistance can indicate poor connections or damaged wire.	NOTE: Never replace the battery in a galvanometer with another kind of a battery. Also, never test an electrical blasting cap or other blasting circuit with any instrument except an approved galvanometer.

METHOD OF EVALUATION:

Instructor observation and/or testing

OPERATION SHEET: SL 4-1-7

COMPETENCY: Lubrication Procedures for Mining Machines

COURSE: Mine Equipment Maintenance

Unit: IV Mining Procedures, Machines & Equipment

OBJECTIVE: Given lubrication diagrams, specifications, and intervals, effective lubrication of mining machinery is made.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	**TEACHING/LEARNING ACTIVITIES**
1. Obtain lubrication chart for specific piece of machinery from manufacturer.	IL 4-2-1
2. Use the correct tools and equipment for proper lubrication.	
3. Clean lubrication point areas to remove dirt and debris.	
4. Remove fill plug to fill spur and bevel gear cases with a medium weight transmission oil, approximately a viscosity index of 90.	
5. Remove fill plug or filler opening protector for filling hydraulic system to recommended level with a quality hydraulic oil of approximately 90 weight viscosity.	
6. Use a rose or grease gun to lubricate all bearing points, chassis and motors with a high temperature bearing grease.	NOTE; A lubrication chart is on the back of this sheet to aid in becoming familiar with lubrication specifications, location and interval of lubrication points.

METHOD OF EVALUATION: Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-8

COMPETENCY: Bottom Cut a Face With a Cutting Machine

COURSE: Mine Equipment Maintenance

Unit: IV Mine Procedures & Mining Equipment

OBJECTIVE: Undercut a coal face as the first step in the conventional mining cycle

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove safety chain on locks from cutter bar.	IL 4 - 2 - 2
2. Turn on the cutter chain motor.	IL 4 - 2 - 3
3. Sump or tram the cutting machine to the coal face at the right rib.	
4. Lower the cutting bar so the heel of the car is on the floor and the bar will cut a continuation of the floor.	
5. Tram the machine ahead in low gear and as the cutter bar progresses into the material, the point of the cutter bar can be slowly moved to the left by the bar swing lever.	
6. Turn the bugduster on when the cutter is about halfway into the face.	
7. Continue moving the bar to the left and reposition machine when necessary to complete the cut.	
8. Reposition machine by lifting weight off the front wheels. This is done by lowering boom downward.	
9. Swing boom to the right. This causes the front end of the cutter to slow to the left. This procedure properly executed is sufficent to cut a 22 foot face.	Note: Do not allow more than 24 inches between the face and the bar hanger.

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-9

COMPETENCY: Drill a Predetermined Face Pattern

COURSE: Mine Equipment Maintenance Unit: IV Mine Procedures & Mining Equipment

OBJECTIVE: Prepare a face for the second stop in the conventional mining cycle.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Tram the machine to the face.	IL 4-3-2
2. Position the boom and drill feed frame for the first hole.	
3. Apply hydraulic brakes.	
4. Push feed extension lever forward until picks point at front end of feed frame are pressed against the face.	
5. Allow lever to return to neutral position.	
6. Push drill retention lever forward and leave in forward position.	
7. Push drill feed lever forward and leave in this position.	
8. Regulate feed rates with flow control to prevent stalling of rotation unit.	
9. Pull drill feed lever all the way back after drill rotation unit has traveled full length of drill feed.	
10. Pull drill rotation lever back to neutral.	
11. Pull feed extension lever back until feed frame has retracted for enough to allow positioning for the next hole.	
12. Position drill for the next hole and repeat.	Note: Never retract feed extension before auger is fully retracted from hole in the face. This results in bent and broken augers.

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-10

COMPETENCY: Operate a Loading Machine

COURSE: Mine Equipment Maintenance Unit: IV Mine Procedures & Mining Equipment

OBJECTIVE: Load a shuttle car or other conveyance with a loading machine during a conventional mining cycle.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Tram loader into shot coal at the face. 2. Position loader rear conveyor in shuttle car. 3. Start loader conveyor. 4. Activate gathering arm system. 5. Advance loader into the coal face. 6. Stop conveyor when the shuttle car is loaded. 7. Repeat cycle. 8. Tram loader from one section to another by maintaining gathering head and rear conveyor in a revised or lowered position for adequate clearance.	IL 4-4-2 Note: Be sure helper or other persons are in the clear before swinging the rear conveyor. Also, keep rear conveyor away from the roof.

METHOD OF EVALUATION:

Instructor testing and/or observation.

OPERATION SHEET: SL 4-1- 11

COMPETENCY: Load and Discharge a Shuttle Car

COURSE: Mine Equipment Maintenance

OBJECTIVE: Load a shuttle car at the face. Tram the car to the discharge point and discharge the load.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Turn off car lights when approaching loader or continuous miners.	IL 4-5-2
2. Position shuttle car under rear conveyor of loader or continuous miner.	
3. Signal loader or continuous miner operator to keep rear conveyor down in shuttle car.	
4. Convey coal to the front of the car as it is loaded at the rear.	
5. Distribute load evenly.	
6. Tram to discharge point.	
7. Start feeder-breaker if discharging onto a conveyor.	
8. Elevate discharge end of coal over conveyor, feeder-breaker or mine car.	
9. Start conveyor and unload coal.	Note: Always face direction of travel Gauge load height and do not overload shuttle car. Sound gong when making turns or going through check curtains.
10. Return to face.	

METHOD OF EVALUATION:

Instructor evaluation and/or testing.

OPERATION SHEET: SL 4-1-12

COMPETENCY: Operate a Roof Bolter

COURSE: Mine Equipment Maintenance

Unit: IV Mine Procedures and Mine Equipment

OBJECTIVE: Bolt a roof for roof control.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Test top in immediate area where hole is to be drilled.	IL 4-6-2
2. Take down or support loose material.	
3. Position machine.	
4. Drill hole. Insure drill stem is properly seated in drill head socket.	
5. Insert bolt into hole. Shell should fit snug in hole.	
6. Tighten bolt. Bolt should be tightened to first stalling of drill.	Note: Check timbers near installation. They may have been loosened after roof bolting.

METHOD OF EVALUATION:

Instructor observation and/or testing.

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OPERATION SHEET: SL 4-1-13

COMPETENCY: Complete a Mining Cycle with a Continuous Miner

COURSE: Mine Equipment Maintenance Unit: IV Mine Procedures and Mine Equipment

OBJECTIVE: Operate a continuous miner through its mining cycle of cutting, loading and discharging.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Insure all personnel are clear of the machine.	IL 4-7-1
2. Turn the headlights on.	IL 4-7-2
3. Start the pump motor.	
4. Adjust the gathering head. For macimum cleanup efficiency the gathering head should rest against the mine floor and be free to float.	
5. Start the gathering/conveyor motor. Insure the cutter boom is above mid-point.	
6. Tram the machine to the face, keeping the rear conveyor feeding into the shuttle car.	
7. Raise the shear lever to raise the cutter head to the desired height.	
8. Open the water valve for dust suppression.	
9. Start the cutter motors.	
10. Sump the cutter head approximately 30 inches into the coal face.	
11. Lower the shear control lever to operate the cutting boom in a downward direction.	
12. Return the shear lever to the neutral position and back the machine up approximately 30 inches. This trims ridges and smooths the bottom for subsequent cleanup.	

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-14

COMPETENCY: Operate a Belt Conveyor

COURSE: Mine Equipment Maintenance

OBJECTIVE: Operate a conveyor belt from a working face or discharge point to a main haulage device.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Operate winch lines to position the bridge and advance conveyors. 2. Cleanup spillage from all conveyors and dump points. 3. Reset any loose timbers and add timbers where needed. 4. Assist in adding or taking off pan and chains and be responsible for pan tools and supplies. 5. Assist in rockdusting and ventilation. 6. Maintain dust sprays.	IL 4 - 10 - 2

METHOD OF EVALUATION:

Instructor evaluation and/ or observation.

OPERATION SHEET: SL 4-1-15

COMPETENCY: Operate Locomotives

COURSE: Mine Equipment Maintenance Unit: IV Mine Procedures & Mine Equipment

OBJECTIVE: Operate a locomotive to service production sections.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove derail (a device to prevent cars from entering the main track.) 2. Throw switches. 3. Connect cars to locomotive. 4. Travel toward main discharge point in a safe manner to prevent derailment or runaway trips. 5. Insure communication and/or signals are used to alert personnel that a trip is being made. 6. Unload cars at dump area. 7. Return cars to loading area. Insure potential derailments and runaway hazards are avoided. 8. Place derail in back of cars.	IL 4 - 11 - 3

METHOD OF EVALUATION:

Instructor observation and/or testing.

OPERATION SHEET: SL 4-1-16

COMPETENCY: Operate a Scoop

COURSE: Mine Equipment Maintenance Unit: IV Mine Procedures and Mining Equipment

OBJECTIVE: Load materials, cleanup entries and crosscuts

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Turn control to neutral and set brake 2. Lower scoop to bottom. 3. Approach loose material with scoop on bottom. 4. Raise scoop when full to clear bottom to give adequate clearance and visibility over scoop. 5. Tram and maneuver scoop to unloading point by maneuvering control levers, pedals and steering wheel.	IL 4 - 12 - 2 Note: Maintain adequate clearance at all times and be aware of other persons in the area.

METHOD OF EVALUATION:

Instructor evaluation and/or testing.

OPERATION SHEET: SC 5-1-1

COMPETENCY: Draw Orthographic Projections

COURSE: Mine Equipment Maintenance UNIT V MINE MECHANICAL MAINTENANCE

OBJECTIVE: Draw a three-dimensional object on a two dimensional surface

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1 Place the object in its natural position or in the position in which it is to be used. 2. Place the object so that it faces parallel to the princiapl planes of projection. 3 Turn the object so that its most important or more descriptive face is parallel to the vertical plane. 4. Select the views that will show the most visible lines. 5. Draw solid lines if the line can be seen from the point of sight. 6. Draw dashed lines if the line is hidden. 7. Draw thrid quadrant projection.	IL 5-1-1 IL 5-1-2 IL 5-1-3

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-1-2

COMPETENCY: Draw Auxiliary Views

UNIT V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

OBJECTIVE: Draw true angles between lines and between plane faces when they do not appear in the normal three prcinciple views.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Place the auxiliary plane of projection perpendicular to one of the planes of projection already in use. 2. Place the auxiliary plane parallel or perpendicular to some line or plane face of the object. 3. Choose the principla plane to use according to the shape and position of the object and the problem to be solved. 4. Use orthographic projection when making auxiliary views.	IL 5-1-1 IL 5-1-2 IL 5-1-3

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-1-3

COMPETENCY: Draw Section Views

UNIT V Mine Mechanical Maintenance

COURSE: Mine Equipment Maintenance

OBJECTIVE: Develop sectional views to show the interior parts of an object when dash lines become too numerous.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Choose the principla section view to be drawn. 2. Draw cutting plane lines or centerlines to show the location of the cutting plane(s). 3. Employ crosshatching or section lining where the view actually cuts the material of which the object is made. 4. Draw section lines of a 45 degree angle to the horizontal. 5. Crosshatch adjacent parts when several adjacent parts of a machine are of the same material and are cut by a section plane. 6. Omit all hidden lines in the section view.	IL 5-1-1 IL 5-1-2 IL 5-1-3

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-1-4

COMPETENCY: Draw Break Conventions

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Draw long members of uniform crosssection with a conventional break.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Choose a long member of uniform cross section. 2. Draw the member with the conventional orthographic projection. 3. Redraw the lengthwise plane of the drawing with a break convention. 4. Give the appearance of breaking the shape of the cross section. 5. Show the correct length of the member with a dimension.	IL 5-1-1 IL 5-1-2 IL 5-1-3

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-1-5

COMPETENCY: Redraw Structural Details

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Draw or redraw structural details based upon a completed structure.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Sketch with pencil and a straight edge or freehand the connections to other members. 2. Use actual rather than nominal member sizes for sketches. 3. Draw connections with precision to insure construction without difficulty. 4. Detail dimensions. Lengths may vary, but net distances between holes cannot vary. 5. Provide written information when structural details are confusing or tax one's ingenuity.	IL 5-1-1 IL 5-1-2 IL 5-1-3

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-2-1

COMPETENCY: Adjust Torch for Neutral Flame.

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Adjust the flame for a smooth inner cone.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check the equipment to insure all parts are in good condition.	IL 5-2-1
2. Open the acetylene torch valve slightly.	IL 5-2-2
3. Light the acetylene with a spark lighter.	IL 5-2-3
4. Begin turning the oxygen by opening the torch oxygen valve.	
5. Continue to turn the oxygen torch valve until the middle flame is eliminated and a rounded inner core is seen.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-2-2

COMPETENCY: Produce Beads by Puddling

COURSE: [illegible] Maintenance

UNIT V Mine Mechanical Maintenance

OBJECTIVE: [illegible] to provide a molten puddle of metal along the seam of parts to be welded.

[illegible]	TEACHING-LEARNING ACTIVITIES
[illegible]	[illegible]

METHOD OF EVALUATION: Instructor evaluation/testing.

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OPERATION SHEET: SC 5-2-3

COMPETENCY: Join Two pieces with an Outside Corner Weld

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Become able to weld by using some of the present metal as the filler metal.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Bring the torch to that part of the joing where the weld is to start. 2. Position metal. An overlap of one side is used as filler material. 3. Tack the two pieces together at their ends. 4. Tilt slightly the torch tip. This makes the flame point inward toward the flat or horizontal surface. 5. Test penetration by bending the two pieces of metal open. Any cracking or breaking of the metal at the joint will indicate a lack of penetration or fusion.	IL 5-2-4

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-2-4

COMPETENCY: Perform a Flange Weld Without Rod

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Use a welding torch in welding without welding rod.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Bend a 90 degree flange about 1/4–1/2 in. long on two pieces of sheet steel about 1/32 to 1/16 in. thick. 2. Place thw two flanges together along their lengths. 3. Fuse the two flanges with the welding torch. 4. Use the flanges as the filler metal. 5. Test penetration by opening the two pieces of metal. Cracking or breaking of the metal at the joint indicates a lack of penetration or fusion.	IL 5-2-6

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-2-5

COMPETENCY: Lap Weld An Outside Corner

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Be able to joint weld one piece of sheet metal over another piece of sheet metal.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Place the two pieces close together with no gap. 2. Concentrate the torch flame on the lower surface. 3. Add enough welding rod metal to crown the weld slightly. This insures that the welded portion is at least as thick as the original metal. 4. Inspect the weld for an even bead, consistency of width, cleanliness, and good general appearance.	IL 5-2-7 IL 5-2-8 IL 5-2-9 IL 5-2-10 IL 5-2-11

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-2-6

COMPETENCY: Joint Weld an Outside Corner

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Join to pieces of metal with an outside corner joint weld.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Place the two pieces of metal 90 degrees angles to each other without overlap. 2. Begin weld at seam and progress left to right or vice versa. 3. Concentrate the troch flame in the middle of the seam. This insure the edges of both pieces of metal are melted to strengthen the weld. 4. Inspect the weld for cleanliness, even bead, consistency of width and good appearance.	IL 5-2-7 IL 5-2-8 IL 5-2-9 IL 5-2-10 IL 5-2-11

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-3-1

COMPETENCY: Setup Equipment for Cutting

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Setup and light the equal pressure type hand cutting torch

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Check the equipment to make sure all parts are in good condition.	IL 5-3-1
2. Inspect the regulators. The adjusting screws of the regulators should be turned all the way out.	
3. Open the oxygen cylinder valve very slowly until the regulator high pressure gauge reaches its maximum reading.	
4. Turn the cylinder valve all the way open to close the double-seating valve.	
5. Stand to one side of the guages while simultaneously conducting step four.	
6. Open the acetylene valve slowly 1/4 to 1/2 turns.	
7. Open the torch oxygen valve one turn.	
8. Open next the oxygen regulator to give the desired operating cutting pressure.	
9 Open the acetylene torch valve one turn.	
10. Turn the acetylene regulator screw in slowly until the low pressure acetylene gauge indicates the pressure corresponding to the acetylene valve.	
11. Close the torch acetylene valve.	
12. Light the torch by opening the acetylene valve approximately 1/16 turn and igniting the mixture.	
13. Increase the flow of acetylene until the acetylene flames jump away from the end of the tip slightly.	
14. Open the torch oxygen valve and adjust it to give neutral flames at the tip.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-3-2

COMPETENCY: Cut Steel of 1/8-inch Thickness

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Given a piece of 1/8-inch sheet, an accurate and clean cut can be made.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Adjust torch for a neutral flame. 2. Use the smallest cutting tip available. 3. Point tip in the direction of cutting at a 15–20 degree angle. 4. Keep the end of the preheating inner core just above the metal. 5. Proceed to cut fast enough to provide a slight amount of drag at the line of cutting.	IL 5-3-2

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-3-3

COMPETENCY: Cut Steel of 1/8-inch Thickness or More

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Given a piece of 1/8-inch thickness or more, an accurate and clean cut can be made.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select a cutting tip according to the thickness and kind of metal. 2. Adjust torch for a neutral flame. 3. Hold the torch so the tip is almost vertical to the surface of the base metal to be cut. 4. Start the cut at the edge of the stock and move from left to right' if right-handed. 5. Heat edge to a dull cherry red and open the oxygen jet all the way. 6. Move the torch tip at a steady rate as soon as the cutting action starts.	IL 5-3-3

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-3-4

COMPETENCY: Cut Ferrous Alloy Metals

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Given a piece of ferrous alloy metal, an accurate and clean cut can be made.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select a cutting tip for approximately a 20 per cent increase in preheating flame as compared to conventional steel. 2. Adjust torch for a slight carburizing flame. 3. Place metal so that the cutting tip and flame are in a horizontal position. 4. Preheat metal to a white heat. 5. Start cut at the top of the metal and proceed downward in a vertical line. 6. Proceed with a slight, but quick, up-and-down motion of the torch to assist in removing slag. 7. Use a mild steel welding rod where the progress of cutting is interrupted by the presence of unmeltable slag.	IL 5-3-4

METHOD OF EVALUATION: Instructor evaluation/testing.

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OPERATION SHEET: SC 5-4-1

COMPETENCY: Adjust and Start Arc Welding Machine

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Given a DC arc welding machine an operator can inspect and start the machine.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. See that the electrode holder is hung on an insulated hanger. 2. Close the main power switch or circuit breaker to the machine. 3. Adjust the machine to the proper current setting depending on the base metal and selected electrode size. 4. Press the magnetic starter ON button on the machine. 5. Readjust the fine adjustment if necessary after running a few practice beads.	IL 5-4-1 IL 5-4-2 IL 5-4-3

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-2

COMPETENCY: Produce an Arc

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Produce an arc between the metal electrode and the base metal.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Place an electrode in the holder.	IL 5-4-4
2. Touch the base metal with the electrode.	IL 5-4-5
3. Withdraw to the correct arc distance or length.	
4. Draw a rather long arc momentarily to preheat the base metal before deposition of filler material (electrode) starts.	
5. Use a glancing or scratching motion with the end of the electrode, or, a straight down-and-up motion.	

METHOD OF EVALUATION: Instructor evaluation/testing;

OPERATION SHEET: SC 5-4-3

COMPETENCY: Maniuplate the Electrode in Various Arcs

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Be able to change the motion, angle and arc length to insure a quality weld

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Progress with either a straight forward or oscillating motion on single layer welds. 2. Insure proper fusion in the root zone (bottom of the weld). 3. Use a small oscillating (back-and-forth) motion along the line of the weld to control and produce a ripple as the thickness of the metal increases. 4. Deposit the first layer in multi-layer welding in a straight forward motion to secure proper fusion in the root zone. Subsequent layers should be deposited with an osicillating motion to buildup the proper contour.	IL 5-4-6

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-4

COMPETENCY: Lay Arc Beads

COURSE: Mine Equipment Maintenance

UNIT V Mine Mechanical Maintenance

OBJECTIVE: Produce several excellent beads on a similar piece of metal.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Produce an arc by touching the end of the electrode lightly to the metal and withdrawing it to the proper gap. 2. Vary gap according to the size and type of electrode used. An an example, a bare electrode should have a gap of 1/8 to 3/16 in., which necessitates a voltage of 20 to 24 volts across the arc. 3. Listen to the sound of the arc. The arc of a bare electrode provides a distinct, crackling or frying sound. 4. Shorten the length of the arc if balls of molten metal form on the end of the electrode.	IL 5-4-7

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-5

COMPETENCY: Arc Weld an Edge Joint

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Join the edges of two or more parallel or nearly parallel members.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Adjust the machine to approximately 80–100 amps.	IL 5-4-7
2. Insert a mild steel 1/8-in. diameter electrode in the holder.	IL 5-4-8
3. Clamp the two pieces together and ground to the table.	
4. Strike an arc.	
5. Lay a bead.	
6. Insure the bead has good contour and penetration.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-6

COMPETENCY: Arc Weld a Butt Joint

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Weld a V-groove butt joint by tacking and laying a continuous bead.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Procure two pieces of 1/8 or 1/2 in. thick cold-rolled steel and grind or cut the metal to a V (45-degree), which should extend within 1/16 in of the bottom.	IL 5-4-8 IL 5-4-9 IL 5-4-10
2. Tack weld the base metal to prevent or control distortion during welding.	
3. Strike the arc and reduce the length of the arc until the hissing sound is heard.	
4. Control the puddle size by the movement of the electrode along the seam.	
5. Be sure the puddle is equally divided between the two pieces.	
6. Break the arc at the end of the seam by moving the arc to the back of the crater and lifting the electrode.	
7. Cool the weld. Remove, slag, if any, and wire brush the weld surface.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-7

COMPETENCY: Arc Weld a Lap Joint

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Join by welding two pieces of plate with only one having its edge joined to the other.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Distribute heat primarily to the bottom plate with a waving motion. 2. Hold electrode in a slight angle position into the joint. 3. Raise the electrode slightly as the arc travels over the edge of the upper piece. 4. Finish weld bead with a slight crown. 5. Inspect weld for an even width and good fusion between the bead and base metal. 6. Cool the weld. Remove slag, if any, and wire brush the weld surface.	IL 5-4-8 IL 5-4-9 IL 5-4-10

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-4-8

COMPETENCY: Arc Weld a Corner Joint

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Join two pieces of plate together with an inside fillet weld or from the outside corner with a butt weld.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Place one piece in a flat position and one in a vertical position. 2. Hold electrode at an equal angle between the pieces. 3. Tilt the fholder end slightly in the direction the electrode is traveling. 4. Finish weld with a concave surface for a fillet weld on the outside corner. 5. Insure both welds are straight, even in width, smooth, clean, and evenly placed, half on one piece and half on the other piece. 6. Cool the weld. Remove slag, if any, and wire brush the weld surface.	IL 5-4-8 IL 5-4-9 IL 5-4-10

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-5-1

COMPETENCY: Prepare Metal

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Given a welding assignment, the metal will be correctly, cleaned, shaped and mounted.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Use mild steel (SAE1010–1020) for practice exercise.	IL 5-5-1
2. Correctly shape the metal, e.g. bevel or chamfer edge.	
3. Wire brush' sandblast or pickle metal to insure cleanliness.	
4. Position metal with each piece correctly aligned with the other.	
5. Insure the correct gap is made at the joint (root face).	
6. Support firmly the metal pieces to avoid accidental movement.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-5-2

COMPETENCY: Start a Weld

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Be able to start an AC weld in the exact position that the bead is to be placed.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Strike the arc in exactly the correct spot on the metal to prevent marring.	IL 5-5-5 IL 5-5-6
2. Position the arc end of the electrode just above the exact spot where the weld is to start.	
3. Lower the helmet before actually contacting the metal with the electrode.	
4. Contact the metal with the electrode.	
5. Start melting and depositing metal on both pieces of metal of the joint as quickly as possible.	
6. Direct the arc until the crater, or puddle is formed, on both sides of the joint before proceeding with the bead.	

METHOD OF EVALUATION: Instructor evaluation/testing.

OPERATION SHEET: SC 5-5-3

COMPETENCY: Restart a Weld

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: To insure that when an AC welding is restarted a weak spot does not occur in the weld.

COMPETENCE -- PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Clean the end of the weld by removing the slag and chipping, and/or wire brushing the weld crater. 2. Strike the arc at the leading edge of the crater. 3. Move arc slowly back to the trailing edge of the crater. 4. Start welding in the usual direction and fashion.	IL 5-5-5 IL 5-5-6

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-5-4

COMPETENCY: Stop a Weld

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Insure a weld is continuous and craters are filled when the weld is stopped.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Complete arc weld to end of metal joint. 2. Lift electrode away from the weld. 3. Observe crater at end of weld. 4. To fill crater, reverse the electrode movement at the end of the weld. 5. Move the electrode to the trailing edge of the crater. 6. Pause until the crater is filled, then lift the electrode slowly until the arce is broken.	IL 5-5-5 IL 5-5-6

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-6-1

COMPETENCY: Calculate Work

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Understand through an example how force acts upon a body.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Determine one foot-pound, given the formula Ft X lbs = Ft. Lb. 2. Raise a weight of 33,000 pounds one fott. 3. Multiply feet (1) times weight (33,000) equals one fott-pound. 4. Given a weight of 66,000 pounds raised 3 feet, determine the foot pounds required to raise this weight. 5. Divide 66,000 by 33,000. This equals two. 6. Multiply three (the height) times 2 equals 6. The answer is 6 foot-pounds.	IL 5-6-1 IL 5-6-2

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-6-2

COMPETENCY: Calculate Power

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Understand the "yardstick" used to determine power or horsepower through an example.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Determine one horsepower given the formula Ft. X Lbs/Mine. X 33,000 = horsepower. 2. Raise a weight of 33,000 pounds one foot. 3. Divide this weight times 33,000 by one minute times 33,000. This equals one horsepower. 4. Given a weight of 66,000 pounds raised three feet in 5 minutes, determine the horsepower. 5. Multiply 2 times 3, which equals 6. Also, multiply 5 times 1, which equals 5. 6. Dividie 6 by 5, which equals 1.5. The answer is 1.5 horsepower.	IL 5-6-1 IL 5-6-2

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-6-3

COMPETENCY: Calculate Efficiency

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Determine the efficiency of an mechanical unit given variables.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Determine the efficiency of a 4 reduction gearing when the input is 100 per cent.	IL 5-6-2 IL 5-6-3
2. Multiply first reduction by the common constant of .01 or 1 per cent loss of efficiency for each reduction times 100. This totals 1 or 99 per cent for the first reduction.	
3. Square 99 by the total number of reduction in the gear train. Thus' 99 to the fourth power would be approximately 8 per cent or a total efficiency of 91 per cent.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-6-4

COMPETENCY: Calculate Firction Rates

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Understand the maximum force of static friction between two surface is proportional to the normal force between the surfaces.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Calculate the maximum inclination of hill that a jeep can climb if the coefficient of friction is 0.2. 2. Determine the limiting angle if friction equals force of gravity times tension or weight of object. 3. Thus, if the tangent of the limiting angle equals the angle of slip, which equals 0.2, then the limiting angle equals 11°3.	IL 5-6-3 IL 5-6-4

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-7-1

COMPETENCY: Install Gears

COURSE: Mine Equipment Maintenance

UNIT V Mine Mechanical Maintenance

OBJECTIVE: Install gears accurately and carefully to avoid later problems.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Support and securely anchor gear drive units to prevent misalignment of gears or shafts.	IL 5-7-1
2. Use good quality, keylocked mechanical couplings to couple the shafts.	
3. Use flexible type mechanical couplings for slight angular or linear shaft misalighment.	
4. Load gear drive units properly and do not subject them to extreme or sustained overloads.	
5. Insist on torque limiting devices if the possibility of overloading is evident.	
6. Operate unit at partial load for one or two days to allow final break-in of gears.	
7. Drain the oil and flush the housing after the unit has been operating for a period of two weeks.	
8. Change oil thereafter at 6 month intervals or 2,500 hours.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-7-2

COMPETENCY: Install Bearings

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Mount spherical roller bearings by using a lock nut and lock washer as a protective device.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Clean the shaft and bearing housing thoroughly. 2. Clean the dirt out of keyways, grooves and remove burrs. 3. Clean and oil bearing seats. 4. Press bearings on straight and square. 5. Press only on the ring which takes the tight fit. 6. Press bearings until they are seated against the shaft or housing shoulder. 7. Bearing installation is just the reverse of bearing removal. Be sure not to score the shaft or threads. 8. Do not leave bearings exposed in partial assemblies. Cover the bearings until you are ready to complete the assembly. Any clean cloth will do so long as the bearings are well covered.	IL 5-7-2

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-7-3

COMPETENCY: Adjust and Align Gears

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Prevent excessive wear vibration and noise by properly adjusting and aligning gears.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Assemble lapped gears of an even ratio with the teeth marked together.	IL 5-7-3 IL 5-7-4 IL 5-7-6
2. See that gears are close fit on the shaft.	
3. Make sure there is a correct amount of backlash.	
4. Check the tooth bearings.	
5. Make sure the lock nuts and bolts, etc. are tight.	
6. Be sure that both pinion and gear are locked in both directions.	
7. Lubricate gears properly before operating under power.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-9-2 con't

COMPETENCY:

COURSE:

OBJECTIVE:

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
4. Examine the spline shank for visible cracks. 5. Check the inner race ball groove for excessive wear. Scrap if cracked or badly chipped. Remove heavy rolled-up burrs. 6. Check each ball cage by handing on a wire hook and bell testing. Scrap if cracked. The ball slot indentation should not be more than .020 in. 7. Visually inspect the drive balls and micrometer check for size. Ball slightly scored or not worn More than .002 in. undersize may be reused. 8. Examine the pilot for crakcs and excessive wear around the center holes. Scrap if it is flattened out or worn. 9. Shaft retainer parts should be examined for wear and replaced when necessary.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-10-1

COMPETENCY: Disassemble a Gathering Head Reducer

COURSE: Mine EQuipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Remove a gathering head reducer and disassemble for subsequent rebuild.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Disassemble cluth unit.	IL 5-10-1
2. Remove bearing cup and cap.	
3. Remove bearing cone on idler shaft.	
4. Separate spline idler shaft and gear inside housing.	
5. Remove spacer on idler shaft	
6. Remove bearing cup over cone on pinion.	
7. Remove six flat socket head mounting screws.	
8. Disassemble bearing cones on gear and pinion.	
9. Remove gear throu open top of case.	
10. Remove pinion shaft thru hole in case.	
11. Remove bearing cup in two blind bores.	

METHOD OF EVALUATION: Instructor observation/testing.

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OPERATION SHEET: SC 5-10-2

COMPETENCY: Disassemble a Traction Reducer

COURSE: Mine Equipment Maintenance

UNIT V Mine Mechanical Maintenance

OBJECTIVE: Disassemble a traction reducer for subsequent rebuild.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Install cone on opposite end of pinion shaft. It may be necessary to heat cone. Install cup over cone.	IL 5-10-2
2. Install cup over cone on end of pinion shaft, and bolt cap "Y" in place.	
3. Install spacer on splined end of pinion shaft and bearing cone on plain end. Insert pinion through hole in side of case and spline into hub of gear.	
4. With gear and pinion in place, insert gear through top of case.	
5. Install cup of pinion bearing, and cap. Shims behind cap provide bearing adjustment.	
6. Install cone on pinion. Insert pinion through hole in side of case and, with gear in poisition, spline pinion shaft into hub of gear.	
7. Install bearing cone on gear and caup in case. Insert gear through open top of case.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-10-3

COMPETENCY: Disassemble a Conveyor Drive Reducer

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Disassemble a conveyor drive reducer for subsequent rebuild.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Set output shaft subassembly in place and remove bearing carrier, shims.	IL 5-10-3 IL 5-10-4
2. Slide spur gear off out put shaft and remove bearings.	
3. Disassemble oil seap in bearing carrier.	
4. Remove bearing retainer plate from spur pinion bearing carrier and remove snap rings on pinion shaft.	
5. Remove complete sub-assembly in gear housing.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 5-10-4

COMPETENCY: Disassemble Steering and Drap Link Assys

COURSE: Mine Equipment Maintenance UNIT V Mine Mechanical Maintenance

OBJECTIVE: Disassemble steering and drag links for subsequent rebuild.

COMPETENCE PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Disassemble crossover drag link.	IL 5-10-5
2. Remove roll seat, spring and screw plug.	
3. Disassemble drag link to front steering arm.	
4. Disassemble drag link to steering segment.	

METHOD OF EVALUATION: Instructor observation/testing.

OPERATION SHEET: SC 6A-1

COMPETENCY: Interpret Pressure Gauge

COURSE: Mine Equipment Maintenance UNIT VI Hydraulics

OBJECTIVE: Be able to interpret all pressure gauges

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Setup pressure gauge to hand pump. 2. Record measurement. 3. Repeat for various gauges.	

METHOD OF EVALUATION: Accuracy of measurement

OPERATION SHEET: SC 6A-2

COMPETENCY: Interpret Flow Meter

COURSE: Mine Equipment Maintenance UNIT VI Hydraulics

OBJECTIVE: To be able to interpret flow meters.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Setup flow meter to pump. 2. Reocrd measurement. 3. Repeat for various flow meters.	

METHOD OF EVALUATION: Accuracy of measurement.

OPERATION SHEET: SC 7 - 1 - 1

COMPETENCY: Build Model Atom

COURSE: Mine Equipment Maintenance **Unit:** VII A Elements of Electricity

OBJECTIVE: To be able to identify the basic particles which make up the atom.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Use styrofoam balls and toothpicks to build an atom 2) Label protons, neutrons and electrons 3) Show the electrical charge of each particle.	IL 7 - 1 - 1

METHOD OF EVALUATION: Label particles
Correct charges

OPERATION SHEET: SC 7 - 1 - 2

COMPETENCY: Demonstrate Insulators and Conductors

COURSE: Mine Equipment Maintenance Unit: VII A Elements of Electricity

OBJECTIVE: To be able to idenfity materials that are conductors or insulators

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Build test light with battery, wire and light bulb 2) Test each piece of material to determine whether it is a conductor or an insulator Wood Cork Copper Wire Glass Nail Aluminum Foil Paper Rubber Paper Clip Plastic	IL 7 - 1 - 4

METHOD OF EVALUATION:

Correct identification of conductors and insulators

OPERATION SHEET: SC 7-1-3

COMPETENCY: Show magnetic lines of Flux

COURSE: Mine Equipment Maintenance **Unit:** VII A Elements of Electricity

OBJECTIVE: To be able to demonstrate magnetic field around wire which is carrying current.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Connect wire to one terminal of battery, run through hole in paper, connect to other terminal. 2) Sprinkle iron filings on paper 3) Draw sketch of pattern created. 4) Coil wire under paper, connect to battery, sprinkle iron filings and draw pattern.	IL 7-1-2 IL 7-1-3

METHOD OF EVALUATION:

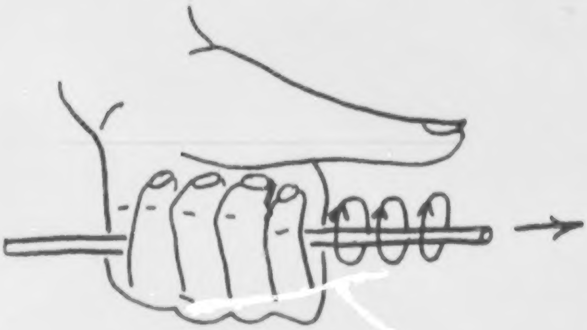
Drawings of magnetic field

OPERATION SHEET: SC 7-1-4

COMPETENCY: Demonstrate "Rule of Left Hand"

COURSE: Mine Equipment Maintenance Unit: VII A Elements of Electricity

OBJECTIVE: To be able to determine the direction of magnetic field around a wire when the current direction is known.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Grasp the conductors in the left hand, with the thumb pointing in the direction of the current flow. 2) The direction of the fingers will indicate the direction of the magnetic lines of force. 	

METHOD OF EVALUATION:

Correct determination of direction

OPERATION SHEET: SC 7-1-5

COMPETENCY: Magnetic Force in a Coil

COURSE: Mine Equipment Maintenance Unit: VII A Elements of Electricity

OBJECTIVE: To show how magnetic force increases as the number of turns increase

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Take a length of wire and make a coil of 5 turns	IL 7-1-2
2) Connect ends to a dry cell	IL 7-1-3
3) Place coil under piece of paper and sprinkle iron filings.	
4) Draw the pattern made by the iron filings.	
5) Increase the size of the coil to 15 turns.	
6) Draw the pattern.	
7) Compare the patterns on the two drawings	

METHOD OF EVALUATION:

Construction of coils
Drawings of magnetic fields
Comparison of difference

OPERATION SHEET: SC 7-1-6

COMPETENCY: Elements of a Circuit

COURSE: Mine Equipment Maintenance Unit: VII A Elements of Electricity

OBJECTIVE: To be able to identify four basic elements of any electric circuit.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Make a list of the four basic elements of an electric circuit	IL 7-1-8
2) List examples of each	
Source: battery generator diode bridge line	
Conductor: Wire frame of machine rail	
Control: switch contactor linestarter	
Load: light bulb motor coil resistor electromagnet	

METHOD OF EVALUATION:

List of Elements
List of Examples

OPERATION SHEET: SC 7 - 1 - 7

COMPETENCY: Series and Parallel Batteries

COURSE: Mine Equipment Maintenance Unit: VII A Elements of Electricity

OBJECTIVE: To be able to determine the difference between series and parallel circuits

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1) Connect two dry cells in parallel. Measure voltage on the lead.	
2) Connect two dry cells in series. Measure the voltage on the leads.	
3) Connect three dry cells in parallel. Measure the voltage.	
4) Connect three dry cells in series. Measure the voltage.	
5) Compare the measurements and write a paragraph describing the difference between series and parallel	

METHOD OF EVALUATION:

Wiring circuits
Voltage readings
Comparison of series and parallel

OPERATION SHEET: SC 7-2-1

COMPETENCY: Idenfity Wiring Diagram Symbols

COURSE: Mine Equipment Maintenance Unit VII B Basic A.C. Circuit

OBJECTIVE: To be able to identify symbols used to represent electrical components on a wiring diagram.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
Draw the wiring diagram symbol for the following electrical components 1) Fuse 2) Circuit Breaker 3) On-Off Switch 4) Push Button Switch Normally Open 5) Off Run Start Switch 6) Light 7) Contactor 8) Coil 9) Resistor 10) Variable Resistor 11) Motor (single phase) 12) Motor (3-phase)	IL 7-2-1 NOTE: Some latitude must be allowed for wiring diagram symbols, as different manufacturers may identify components differently on their wiring diagrams.

METHOD OF EVALUATION: Correct drawing of symbols

OPERATION SHEET: SC 7 - 2 - 1 (conti

COMPETENCY: Identify Wiring Diagram Symbols

COURSE:

OBJECTIVE:

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
13) Mercury Switch - N.O.	
14) Mercury Switch - N.C.	
15) Electrical Interlock Contact	
16) Time Delay Relay	
17) Linestarter	
18) Overload Heater and Contacts	
19) Transformer	

METHOD OF EVALUATION:

OPERATION SHEET: SC 7-2-2

COMPETENCY: Identify Electrical Components

COURSE: Mine Equipment Maintenance **Unit:** VII B Basic A.C. Circuits

OBJECTIVE: To be able to identify commonly used electrical components

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
Given a basic A.C. Training Panel, identify the following electrical components 1) Fuse 2) Circuit Breaker 3) Rheostat 4) On-Off Switch 5) Push Button Switch 6) Off-Run-Start Switch 7) Overload Relay 8) Linestarter 9) Electrical Interlock 10) Mercury Switch	IL 7-2-2

METHOD OF EVALUATION: Correct identification of components

OPERATION SHEET: SC 7-2-3

COMPETENCY: Draw Elementary and Schematic Diagrams

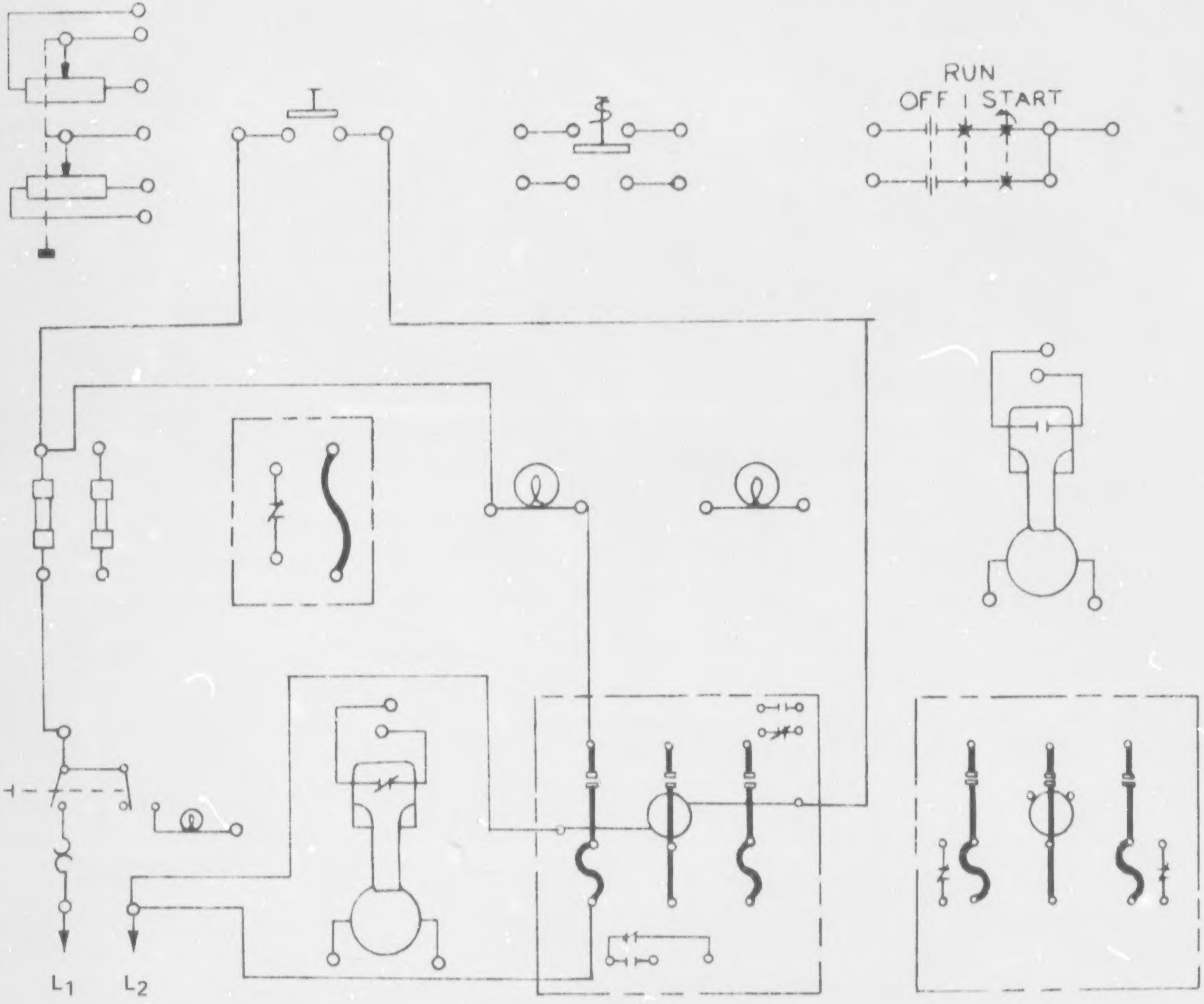
COURSE: Mine Equipment Maintenance   **Unit:** VII B Basic A.C. Circuits

OBJECTIVE: To be able to demonstrate the difference between elementary and schematic drawings and how to use each.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Draw an elementary wiring diagram for a circuit containing a source, a circuit breaker, a fuse, a switch controlling current to the coil of a linestarter, and a light controlled by the contacts of the linestarter 2) Draw the schematic diagram of the same circuit.	IL 7-2-1 IL 7-2-2 IL 7-2-5

METHOD OF EVALUATION:

Elementary Drawing Accuracy
Schematic Drawing Accuracy


RUN
OFF
START
L1
L2

278

279

OPERATION SHEET: SC 7-2-4

COMPETENCY: Demonstrate Switches

COURSE: Mine Equipment Maintenance Unit: VII B Basic A.C. Circuits

OBJECTIVE: To be able to demonstrate various control devices used in basic A.C. circuits.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using an A.C. source, and a light, demonstrate how an on off switch controls the flow of current through the circuit.	IL 7-2-3 IL 7-2-4
2) Substitute a push-button switch and show its operation when normally closed and when normally open.	
3) Install a three position Off-Run-Start switch and demonstrate the combination of contacts.	
4) Add to the circuit a solenoid operated relay to control the light.	

METHOD OF EVALUATION: Demonstration of switches

OPERATION SHEET: SC 7-2-5

COMPETENCY: Demonstrate fuse, circuit breaker and overload

COURSE: Mine Equipment Maintenance **Unit:** VII B Basic A.C. Circuits

OBJECTIVE: To be able to demonstrate the function of circuit safety devices such as fuses, circuit breakers and overloads.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using low amp fuse, apply load causing fuse to "blow" 2) Check the fuse with ohmmeter to show that it is "open" 3) Apply load to low amp circuit breaker causing it to open. 4) Check breaker with ohmmeter. 5) Reset breaker 6) Apply load to overload relay, causing heater to move bi-metallic strip and open contacts. 7) Check open contacts with ohmmeter. 8) Allow overload to cool and recheck contacts.	SC 7-1-9 IL 7-2-5

METHOD OF EVALUATION:

Demonstration of each device.
Safe practices in demonstration
Use of ohmmeter

OPERATION SHEET: SC 7-2-6

COMPETENCY: Disassemble a Linestarter

COURSE: Mine Equipment Maintenance Unit: VII B Basic A.C. Circuit

OBJECTIVE: To be able to disassemble a linestarter and identify the components

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using screwdriver, remove arc shield from contact tips. 2) Remove tips and examine. 3) Remove screws connecting stationary tips to overload relays. 4) Remove coil. 5) Release spring clips and remove electrical interlocks. 6) Remove screws holding overload relay. 7) Check parts and reassemble.	IL 7-2-4

METHOD OF EVALUATION:
Disassembly
Identification of Parts
Assembly

OPERATION SHEET: SC 7-2-7

COMPETENCY: Demonstrate Troubleshooting Techniques

COURSE: Mine Equipment Maintenance Unit: VII B Basic A.C. Circuits

OBJECTIVE: To be able to demonstrate techniques which can be used to locate trouble spots in a circuit.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Use a test light to trace voltages through a circuit.	SC 7-1-8
2) Use a voltmeter to test voltages through a circuit.	SC 7-2-2
3) Use an ohmmeter to test a switch for conductivity.	IL 7-2-7
4) Use an ohmmeter to check a coil for an "open" or a "short".	
5) "Jumper out" a switch to see if it is bad.	

METHOD OF EVALUATION:

Ability to perform each check
Safety precautions taken

OPERATION SHEET: SC 7-3-1

COMPETENCY: Identify Symbols

COURSE: Mine Equipment Maintenance **Unit:** VII C D.C. Mining Machinery

OBJECTIVE: To be able to identify symbols used on a D.C. Wiring Diagram

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. On a D.C. wiring diagram, write the name beside each symbol.	IL 7-3-1

METHOD OF EVALUATION: Correct names on symbols.

OPERATION SHEET: SC 7-3-2

COMPETENCY: Identify Components

COURSE: Mine Equipment Maintenance Unit: VII C D.C. Mining Machinery

OBJECTIVE: To be able to locate and identify electrical components.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Using a wiring diagram on which the names of the symbols have been written, go to a training panel and locate each component. 2. Attach a piece of masking tape to each component with the name written on it.	IL 7-3-2

METHOD OF EVALUATION: Correct identification of Components

OPERATION SHEET: SC 7-3-3

COMPETENCY: Replace Contact Tips

COURSE: Mine Equipment Maintenance **Unit:** VII C D.C. Mining Machinery

OBJECTIVE: To be able to replace contact tips on a D.C. Contactor

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Remove arc chute. 2. Remove contactor assembly bolt. 3. Remove stationary tip and replace with new one. 4. Remove moveable contact tips and turn on. 5. Adjust so that tips strike squarely.	IL 7-3-3

METHOD OF EVALUATION: Proper procedure.
Accurate adjustment.

OPERATION SHEET: SC 7-3-4

COMPETENCY: Adjust Tip Wipe

COURSE: Mine Equipment Maintenance Unit: VII C D.C. Mining Machinery

OBJECTIVE: To be able to adjust contact tips for proper wipe

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove arc chute. 2. Place moveable contact tip in closed position. 3. Set distance between tip and top plate at proper settings by bending armature bracket. 4. Replace arc chute.	Refer to: "A Training Program for D.C. Mining Machinery"

METHOD OF EVALUATION: Proper procedure

OPERATION SHEET: SC 7 - 3 - 5

COMPETENCY: Check Motor Coils

COURSE: Mine Equipment Maintenance

OBJECTIVE: To be able to locate fault in D.C. Motor coil

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Visually examine coil for signs of physical or heat damage. 2. Use V.O.M. to check for continuity in coil. 3. Use V.O.M. to check for short to motor frame or shaft.	IL 7 - 3 - 5

METHOD OF EVALUATION: Proper checks
Ability to locate faults

OPERATION SHEET: SC 7-3-6

COMPETENCY: Adjust Brushes

COURSE: Mine Equipment Maintenance Unit: VII C D.C. Mining Machinery

OBJECTIVE: To properly adjust brushes on D.C. Motor

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Remove commutator end bell. 2. Check brushes for chipping or cracking. 3. Be sure brushes are not sticking in holder. 4. Check pig tail shunts to be sure they are secured properly. 5. Set spring tension to manufacturer's recommended value. 6. Replace worn out or damaged brushes. 7. "Sand in" new brushes for proper radius.	IL 7-3-5

METHOD OF EVALUATION: Proper adjustment of brushes.

OPERATION SHEET: SC 7-3-7

COMPETENCY: Trace Circuit

COURSE: Mine Equipment Maintenance Unit: VII C D.C. Mining Machinery

OBJECTIVE: To trace a basic D.C. circuit.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. On a D.C. wiring diagram, trace the path of the current from the positive lead to the first open switch. 2. Write down what happens as each switch is closed. 3. Trace the path through each component and write down what happens to each. 4. Trace the path until it has gone through all of the switches and components and returned to the negative lead.	IL 7-3-6

METHOD OF EVALUATION: Tracing current path.
Description of each step

OPERATION SHEET: SC 7 - 3 - 8

COMPETENCY: Develop Sequence Chart

COURSE: Mine Equipment Maintenance Unit: VII C D.C. Mining Machinery

OBJECTIVE: To be able to develop a sequence chart showing the sequencing of contactors for each circuit.

COMPETENCE – PROCEDURES/STEPS **The student will be able to:**	TEACHING/LEARNING ACTIVITIES
1. Down left margin of sheet, list all positions of all switches on machine. 2. Across top of sheet, list all contactors on machine. 3. Using training panel, operate each switch and note which contactors close. 4. Develop the chart to show which contactors close with each switch operation and which contactors must open for the next sequence to occur. 5. Check your sequence chart for accuracy on the training panel.	IL 7 - 3 - 7

METHOD OF EVALUATION: Development of Sequence Chart
Accuracy of Chart

JOY

FIVE MOTOR DC SHUTTLE CAR

SEQUENCE CHART

CIRCUITS	DC CONTACTORS												
	1A	M2	dF/eF	dR/eR	M1	P11	S11	P12	11A	P2	S1	P1	21A
PUMP START		x			x						x		
PUMP RUN ON RES.		o			o						o		
PUMP RUN OFF RES.	x	o			o						o		
TRACTION 1st POS. FOR.	o	o	x		o						o		
TRACTION OFF RES.	o	o	o		o						o		x
TRACTION 2nd POS. FOR.	o	o	o		o					x	■	x	o
TRACTION 1st POS. REV.	o	o		x	o						o		
TRACTION OFF RES.	o	o		o	o						o		x
TRACTION 2nd POS. REV.	o	o		o	o					x	■	x	o
CONVEYOR START	o	o			o		x				o		
CONV. FOR. OFF RES.	o	o			o		o		x		o		
CONV. FAST FOR.	o	o			o	x	■	x	■		o		
CONVEYOR REV. START	o	o			o		x				o		
CONV. REV. OFF RES.	o	o			o		o		x		o		

JOY

10SC25 SHUTTLE CAR

o- CLOSED CONTACTORS
x- NEW DEVELOPMENT
■- MUST OPEN FIRST

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OPERATION SHEET: SC 7-4-1

COMPETENCY: Identify Wiring Diagram Symbols

COURSE: Mine Equipment Maintenance **Unit:** VII D A.C. Mining Machinery

OBJECTIVE: To be able to identify symbols commonly used on A.C. wiring diagrams.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. On an A.C. wiring diagram, wirte the name beside each symbol.	SC 7-2-1 IL 7-2-1

METHOD OF EVALUATION: Correct names on symbols

OPERATION SHEET: SC 7-4-2

COMPETENCY: Disassemble A.C. Motor

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to correctly disassemble an A.C. motor in preparation for repair.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove end bells 2. Disassemble brush and collector ring assembly 3. Remove rotor and shaft 4. Remove stator 5. Check components 6. Reassemble	IL 7-4-1

METHOD OF EVALUATION: Proper disassembly

OPERATION SHEET: SC 7-4-3

COMPETENCY: Determine Lead Marking

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to properly identify the leads of an A.C. motor if the markings have been removed.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Draw connection diagram for motor and identify leads T1, T2, T3, T4, T5 and T6.	IL 7-4-3
2. Take motor lead and mark it T1.	
3. Measure resistance between lead 1 and each of the other 5 leads. Reading should be 2 readings of "X" resistance 2 readings of "1.6 x" 1 reading of "1.8 x"	
4. Mark lead that gives "1.8 x" as lead 5.	
5. Measure resistance from 1 to each of other four leads until you find two leads with "X" resistance. Mark them 4 and 6.	
6. Measure from 4 to the two unmarked leads. The one that measures "X" should be marked 3 and the "1.8 x" should be 2.	
7. Apply power to marked leads per connection. Diagram motor should run at low synchronous speed.	
8. If motor does not run at low synchronous speed, pick lead 4, 5 or 6. Mark it "1" and repeat steps 2 through 7.	NOTE: See "A Training Program for Alternating Current Mining Machinery"

METHOD OF EVALUATION: Proper identification of leads
Motor runs at proper speeds

OPERATION SHEET: SC 7 - 4 - 4

COMPETENCY: Check Stator and Rotor Windings

COURSE: Mine Equipment Maintenance

OBJECTIVE: To be able to check stator and rotor windings for physical damage and short or open conditions

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Examine coil for physical damage, or signs of excessive heat. 2. Using ohmmeter, check coil leads for continuity. 3. Check for short between coil winding and frame (Coil wiring and shaft on rotor coil.)	IL 7 - 4 - 2

METHOD OF EVALUATION: Proper check procedures
Ability to find faults on faulty coils

OPERATION SHEET: SC 7-4-5

COMPETENCY: Check bearings

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to check bearings on an A.C. Motor

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Visually check bearings for loss of clearance, distortion of balls or rollers, marking of races or other physical damage. 2. Check for proper lubrication, and signs of heat damage. 3. Check for proper alignment of bearing of shaft. 4. Check for proper fit of bearing in bearing races. 5. When motor is reassembled, check to see that rotor turns freely.	IL 7-4-2

METHOD OF EVALUATION: Proper checks

OPERATION SHEET: SC 7-4-6

COMPETENCY: Remove Controller Case Cover

COURSE: Mine Equipment Maintenance   Unit: VII A A.C. Mining Machinery

OBJECTIVE: To be able to remove a controller case cover safely and without damaging permissible surfaces.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove bolts from case cover. 2. Block up cover. 3. Slide cover off studs, being careful not to damage threads. 4. Move cover to safe place being careful not to damage permissible surfaces.	

METHOD OF EVALUATION: Removal of cover without damaging threads or surfaces.

OPERATION SHEET: SC 7-4-7

COMPETENCY: Remove Control Panel

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to remove control panel from controller case for repairs.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Prepare blocks on which to sit panel on bottom of case. 2. Disconnect wiring harness and individual conductors 3. Mark wires. 4. Remove supporting bolts. 5. Carefully slide panel onto blocks, and slide out of case. 6. Remove panel from case and place on bench. 7. Secure on bench for repair.	

METHOD OF EVALUATION:

Ability to remove panel without damage.
Safe work practices

OPERATION SHEET: SC 7-4-8

COMPETENCY: Repair Linestarter

COURSE: Mine Equipment Maintenance **Unit:** VII D A.C. Mining Machinery

OBJECTIVE: To be able to repair a faulty linestarter

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Disassemble linestarter 2. Visually check components for signs of heat or physical damage. 3. Using volt ohmmeter, check coil for open or short. 4. Check contact tips and replace if necessary. 5. Check NO and NC electrical interlocks 6. Reassemble, tighten all screws and terminals and test	SC 7-2-6 IL 7-2-4

METHOD OF EVALUATION:

Disassembly
Proper Checks
Replacement of Parts
Assembly and Test

OPERATION SHEET: SC 7-4-9

COMPETENCY: Check Time Delay Devices

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to test time delay devices and identify faults.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Visually inspect device for physical damage.	IL 7-2-3
2. Using volt ohmmeter, check coil for open or short.	IL 7-2-4
3. Energize coil and listen for relay to close	IL 7-2-5
4. Using volt ohmmeter, check for continuity across contact tips.	

METHOD OF EVALUATION: Visual check
Coil check
Contact check

OPERATION SHEET: SC 7-4-10

COMPETENCY: Check Trailing Cable

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to examine a trailing cable and identify potential faults

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Examine cable for excessive tension by looking for signs of "hour glass" in insulation, jocket creeping back from splice, conductor pulled in two.	IL 7-4-4
2. Check for mechanical damage such as crushed cable, excess abrasion, gouges, cuts or punctures.	
3. Check for current overload by looking for blistered jacket, hardened and cracked insulation on inner layers of cable reel.	
4. Check temporary splices for exposed conductors, open ground, kinked cable.	See: "A Training Program for A.C. Minine Machinery"

METHOD OF EVALUATION: Ability to locate faults on cable

OPERATION SHEET: SC 7-4-11

COMPETENCY: Splice Trailing Cable

COURSE: Mine Equipment Maintenance Unit: VII D A.C. Mining Machinery

OBJECTIVE: To be able to install an acceptable temporary splice in a trailing cable

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Locate fault in cable.	IL 7-4-4
2. Cut away damaged portion.	
3. Prepare ends of conductors.	
4. Install mechanical connecting device to conductors so there is equal tension.	
5. Install insulating tapes, being sure no bare conductors are exposed.	
6. Install insulating jacket or covering over splice which will allow cable to move smoothly onto cable reel.	

METHOD OF EVALUATION: Proper mechanical connection
Proper insulation
Neat, unobstructed covering

OPERATION SHEET: SC 7-5-1

COMPETENCY: Use a Feeler Gage

COURSE: Mine Equipment Maintenance **UNIT:** VII E Permissibility

OBJECTIVE: To be able to correctly use a feeler gage to inspect explosion proof enclosures.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select a feeler gage of the desired thickness	IL 7-5-1
2. Hold gage back from end of blade.	
3. Align blade with plan of joint.	
4. Run gage along joint.	
5. Attempt to insert blade in openings along joint.	

METHOD OF EVALUATION:

Use of gage
Ability to recognize excess opening

OPERATION SHEET: SC 7-5-2

COMPETENCY: Check Plane Flange Joint

COURSE: Mine Equipment Maintenance Unit: VII E Permissibility

OBJECTIVE: To be able to recognize permissibility violations in a plane flange joint

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select .004 feeler gage 2. Align blade with joints 3. Run blade along joint. Go completely around case. 4. Note any instances where feeler gage will enter joint.	IL 7-5-2 NOTE TO INSTRUCTOR: Have samples of plane flange joints with violations for students to identify

METHOD OF EVALUATION:

Proper checking procedure
Ability to recognize faults

OPERATION SHEET: SC 7-5-3

COMPETENCY: Check Step Flange Joint

COURSE: Mine Equipment Maintenance Unit: VII E Permissibility

OBJECTIVE: To be able to recognize permissibility violation in a step flange joint.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select .006 feeler gage 2. Align blade with joint 3. Run gage along joint. Go completely around enclosure. 4. Note any instances where feeler gage will enter joint.	IL 7-5-2

METHOD OF EVALUATION:

Proper checking procedure
Ability to recognize violation

COMPETENCY: Check Threaded Joint

COURSE: Mine Equipment Maintenance

OBJECTIVE: To be able to recognize permissibility violations in a threaded joint.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Remove threaded cover 2. Visually check for broken threads. 3. Check internal threads in case. 4. Check area surrounding threads for breaks or cracks. 5. Replace cover. 6. Replace locking device	IL 7-5-2

METHOD OF EVALUATION:

Proper checks
Ability to recognize violations

OPERATION SHEET: SC 7-5-5

COMPETENCY: Check cylindrical joint

COURSE: Mine Equipment Maintenancc Unit: VII E Permissibility

OBJECTIVE: To be able to recognize permissibility violation in a cylindrical joint.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Select .001 round feeler gage. 2. Place gage between rod and surrounding box. 3. Check for openings in excess of .001.	

METHOD OF EVALUATION:

OPERATION SHEET: SC 7-5-6

COMPETENCY: Stuff a Packing Gland

COURSE: Mine Equipment Maintenance Unit: VII E Permissibility

OBJECTIVE: To be able to correctly pack an entrance gland into a explosion proof enclosure

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1. Prepare cable	IL 7-5-3
2. Slide nut and metal tube over cable.	
3. Insert cable through stuffing box.	
4. Wind proper length of asbestos packing into stuffing box.	
5. Insert metal tube into stuffing box over asbestos.	
6. Tighten down nut, leaving 1/8" clearance.	
7. Secure clamp or locking device	

METHOD OF EVALUATION:

Proper method of packing
Acceptable packing gland

OPERATION SHEET: SC 7-6-1

COMPETENCY: Demonstrate Diode Bridge

COURSE: Mine Equipment Maintenance Unit: VII F AC/DC Mining Machines

OBJECTIVE: To be able to demonstrate the method used to rectify alternating current and direct current.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Set up diode bridge on basic diode trainer 2) Apply AC to two legs of bridge. 3) Use oscilliscope to show sine wave form of AC 4) Attach oscilliscope to output (DC) legs of bridge to show wave form of pulsating DC.	J-7A-4

METHOD OF EVALUATION: Demonstration Sine Wave
Demonstration of DC wave form

OPERATION SHEET: SC 7-6-2

COMPETENCY: Determine Direction of Current Flow Through Diode

COURSE: Mine Equipment Maintenance Unit: VII F AC/DC Mining Machinery

OBJECTIVE: To be able to determine the direction of current flow through a diode

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Attach leads of ohmmeter to leads of diode	SC 7-1-8
2) Take resistance reading	SC 7-6-1
3) Reverse leads	
4) Take reading	
5) Compare readings	
6) Position of red and black meter leads on lowest resistance indicates direction of current flow.	
7) Note direction of sumbol on diode.	

METHOD OF EVALUATION:

Resistance readings
Determining direction

OPERATION SHEET: SC 7 - 6 - 3

COMPETENCY: Take Voltage Readings on Logic Box

COURSE: Mine Equipment Maintenance Unit: VII F AC/DC Mining Machinery

OBJECTIVE: To be able to troubleshoot control circuits by taking voltage readings at logic box

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Connect black lead of voltmeter (common) to terminal No. 2. 2) Use wiring diagram to determine function connected to other terminals. 3) Operate function switch. 4) Take voltage reading at input and output terminal of each function. 5) Note those terminals where no voltage is present, or where voltage is not same value as shown on WD.	SC 7 - 1 - 8

METHOD OF EVALUATION:

Proper voltage checks
Ability to locate faults

OPERATION SHEET: SC 7 - 6 - 4

COMPETENCY: Use Logic Box Tester

COURSE: Mine Equipment Maintenance Unit: VII F AC/DC Mining Machinery

OBJECTIVE: To be able to use a logic box tester to locate faults in AC/DC logic box

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Select tester for part number of logic box to be tested. 2) Attach fanning strip of tester to the logic box terminal strip so black lead is on terminal No. 1 3) Use procedural outline on wiring diagram to determine proper sequencing of contactors. 4) Use buttons on tester to simulate machine functions. 5) Observe lights on tester (representing contactors) to be sure the sequencing occurs properly for each function according to the sequence chart. 6) Note any variation from proper sequence.	

METHOD OF EVALUATION: Proper test procedures
Ability to locate and recognize faults.

OPERATION SHEET: SC 7 - 7 - 1

COMPETENCY: Identify SCR

COURSE: Mine Equipment Maintenance Unit: VII G SCR Mining Machines

OBJECTIVE: To be able to identify a silicon controlled rectifier on a piece of mining machinery.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Draw the wiring diagram symbols for a diode.	SC 7 - 6 - 1
2) Draw the wiring diagram symbol for an SCR.	IL 7 - 7 - 1
3) Locate the rectifiers on the SCR training panel.	IL 7 - 7 - 2
4) Determine which are SCR's and what are diodes by locating the "pigtail" which conducts the gate current.	
5) Locate the symbols on the SCR's and on the diodes.	

METHOD OF EVALUATION: Ability to recognize SCR's and diodes

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OPERATION SHEET: SC 7-7-2

COMPETENCY: Demonstrate SCR in DC Circuit

COURSE: Mine Equipment Maintenance Unit: VII G SCR Mining Machines

OBJECTIVE: To be able to demonstrate the characteristics of an SCR in a DC circuit.

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using basic DC SCR-training panel, build circuit shown	IL 7-7-2
2) Close S_1 and S_2. Decrease resistance R_1 until light glows.	
3) Open switch S_1 and note what happens.	
4) Open switch S_2. Close S_2 and note what happens.	
5) Repeat steps 2 - 4.	
6) Explain principle of SCR.	

METHOD OF EVALUATION:

Ability to construct circuit.
Demonstration of SCR
Explanation of what happened.

OPERATION SHEET: **SC 7-7-3**

COMPETENCY: Demonstrate SCR in A.C. Circuit

COURSE: Mine Equipment Maintenance Unit: VII G **SCR Mining Machines**

OBJECTIVE: To be able to demonstrate characteristics of SCR in AC circuit

COMPETENCE – PROCEDURES/STEPS The student will be able to:	TEACHING/LEARNING ACTIVITIES
1) Using basic AC SCR training panel, build circuit shown.	IC 7-7-3
2) Turn R_1 & C_1 to lowest values. 3) Close S_1. 4) Increase R_1 and note what happens. 5) Open S_1. 6) Increase C_1 to maximum 7) Close S_1 8) Slowly decrease R_1. 9) Explain effects of R_1 and C_1 on SCR circuit.	

METHOD OF EVALUATION:

Ability to construct circuit.
Demonstration of SCR
Explanation of effects

INFORMATION SHEETS

and

ASSIGNMENT SHEETS

INFORMATION SHEETS supplement the job sheets and provide the student with related information necessary for completing the assignment jobs with the highest possible degree of understanding. The information units that will be stressed in this course are listed in the Skill Lesson and Information Lesson outline.

ASSIGNMENT SHEETS supplement written material given the student. These sheets provide the studnet with mental activities necessary to learn the "knowing" that accompanies the "doing" of an occupation.

The Information and Assignment Sheets should be prepared by each instructor.